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Diagnosis Threat and Injury Beliefs after mid traumatic Brain Injury

Carter-Allison, Samantha Natalie

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Volume I

LITERATURE REVIEW,

EMPIRICAL RESEARCH PROJECT

AND

SERVICE EVALUATION PROJECT

Samantha Carter-Allison

Institute of Psychiatry, King's College London

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Part 1
LITERATURE REVIEW

The role of diagnosis threat in cognitive
performance following mild traumatic
brain injury

Samantha Carter-Allison

Institute of Psychiatry, King's College London

Supervised by:

Dr Sebastian Potter

Dr Katharine Rimes

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1. ABSTRACT

Background: Diagnosis threat is a form of stereotype threat, where individuals with a history of mild traumatic brain injury (mTBI) have shown performance decrements on cognitive tasks, owing to negative expectancies around cognitive ability elicited by cues in the environment. This study systematically reviews experimental studies to gauge the presence / absence of an effect of diagnosis threat on neuropsychological task performance in mTBI. It also investigates whether methodological variation and methodological quality contribute to variation in study findings.

Method: A systematic search of four online databases (Medline, PyscINFO, SportDISCUS, PsycEXTRA) was conducted to identify diagnosis threat studies that employed an experimental paradigm. Neuropsychological test outcomes were extracted, along with information on inclusion criteria, mTBI diagnostic criteria, participant characteristics and study design. Methodological quality was assessed using modified Scottish Intercollegiate Guidelines Network (SIGN) criteria.

Results: A total of nine studies were identified. Evidence for diagnosis threat was found, although there was considerable heterogeneity across study results. The most robust finding was the impact of diagnosis threat on the cognitive domain of attention / working memory. No clear associations between methodological variation, methodological quality and study outcome were noted.

Conclusions: The review found evidence for diagnosis threat, although the strength of this effect may be smaller than previously thought. Although there was heterogeneity across elements of study design, there was no obvious relationship between these factors and outcome. However, the substantial variation makes comparison difficult. These issues are similar to findings in other examinations of stereotype threat. Further research is needed to replicate findings and add clarity to the impact of diagnosis threat on both objective and

subjective measures, and to further investigate the role of possible moderating variables. A more formal meta-analysis in the area may also be helpful to clarify findings in the research field. Future studies should aim to create established operational definitions and outcomes to improve consistency and comparability between studies.

2. INTRODUCTION

The focus of this literature review is around diagnosis threat, a psychological variable thought to have an influence on performance on neuropsychological tests in individuals with a history of mTBI

2.1 Mild traumatic brain injury and post-concussion syndrome

Mild traumatic brain injuries (mTBI) are common; the incidence of hospital treated patients mTBI is around 100–300/100,000 population, although given many people do not attend hospital following an mTBI, the true prevalence rate is thought to be above 600/100,000 (Cassidy et al, 2004). In the UK, around 1 million people present at hospital following a head injury and of these, 90% are mTBIs (Kay & Teasdale, 2001).

Following an mTBI, it is common for people to report a range of physical (e.g. headaches, dizziness), affective (e.g. irritability, depression) and cognitive (e.g. memory, attention) problems (Al Sayegh, Sandford & Carson, 2010). Such symptoms generally resolve within a few days to months, but a number of people – research estimates range from 5% (Iverson, 2005) to 53% (Dikmen et al, 2010) – continue to experience difficulties beyond the expected recovery period. This phenomena is known in the International Classification of Diseases (ICD-10) as post-concussion syndrome (PCS) (World Health Organisation [WHO], 1992) and is defined under the “Minor Neurocognitive Disorder” category in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V) (American Psychological Association [APA], 2013).

Research into PCS has generally focussed on the cognitive difficulties reported by individuals, with subjective cognitive problems a common difficulty which may differentiate persistent PCS from syndromes with overlapping symptoms (Potter & Brown, 2012). There have been numerous meta-analyses in recent years that have examined the objective cognitive sequelae of mTBI, as measured by neuropsychological tests (Binder et al, 1997; Belanger et al, 2005; Pertab et al, 2009; Belanger, Spiegel, & Vanderploeg, 2010; Rohling et al, 2012) and these, in turn, have been subject to being systematically reviewed (Karr et al, 2014). Whilst these studies indicate a measureable impact in the first few days and weeks after injury, the evidence of longer-term effects is limited. There continues to be ongoing debate as to the aetiology of cognitive symptoms, and the extent to which persistent symptoms experienced by a 'miserable minority' of individuals can be attributed to ongoing cognitive difficulties directly attributable to mTBI (Bigler et al, 2013; Larrabee et al, 2013; Pertab et al, 2009; Rohling et al, 2012).

2.2 Etiology of PCS

Some researchers cite neuropathological damage – such as axonal injury, macroscopic brain lesions, white matter cell damage and metabolic abnormalities – as the cause of ongoing cognitive difficulties (King, 2003) and there is some evidence that mTBI can lead to physiological (Holli et al, 2010) and functional (Dean et al, 2015) brain changes. However, results have been variable and neuroimaging studies have not found a correlation between brain changes and PCS diagnosis (Hofman et al, 2001; Ryb et al, 2014), nor cognitive test performance (Hofman et al, 2002).

Research into non-neurological factors has raised further queries as to the biological basis for PCS. This includes findings that PCS symptoms are found in a healthy population. For example, Dean, O'Neill & Sterr (2012) found PCS symptoms were present to a similar extent in participants with no head injury (34%) compared to those with mTBI (31%). In addition, pre-

injury factors such as gender (Dischinger et al, 2009; Meares et al, 2008; Ponsford et al, 2000), lower scholastic performance (Greiffenstein & Baker, 2010; Stulemeijer et al, 2007) and history of physical or psychiatric problems, such as depression and anxiety (Ponsford et al 2012; Meares et al, 2011) have been found to have predictive value for PCS. A systematic review investigating prognostic factors for persistent symptoms by the WHO Collaborating Centre Task Force on mild traumatic brain injury (Carroll et al, 2004a) found little uniformity in the literature regarding demographic predictors, meaning their relationship to PCS is still unclear. One consistent finding of the Task Force was the relationship between involvement in litigation / compensation issues and slower recovery after mTBI (e.g. Bazarian et al, 1999; Paniak et al, 2002; Binder & Rohling, 1996; Flaro, Green & Robertson, 2007; Tsanadis et al, 2008).

In light of the numerous factors beyond organic damage that appear to play a role in persistent PCS symptoms, the WHO currently states that cognitive deficits beyond 1-3 months post-injury should not be attributed to mTBI in the majority of cases (Carroll et al, 2004b). The complex interplay between biological, psychological and social factors to explain persistent symptoms is now acknowledged (Carroll et al, 2004a; McCrea et al, 2009; MacLeod, 2010), with slow recovery from mTBI often being understood in terms of a diathesis-stress model. Diathesis-stress models suggest that in individuals with a predisposed vulnerability, behavioural disturbance (in this case PCS symptoms) can be triggered by specific stressors (such as an mTBI). Lishman (1988) proposed that PCS may have an organic aetiology, but that psychological factors are primarily responsible for its maintenance. More recently, Silverberg & Iveson (2011) reviewed the literature and concluded that a biopsychosocial conceptualisation of both the development and maintenance of PCS best fits the data and that Lishman's model be updated to reflect this.

2.3 The role of beliefs and expectations

There is a growing body of literature that suggests beliefs and expectations around mTBI prognosis can play a role in persistent cognitive difficulties. For example, the 'expectation as etiology' hypothesis (Mittenberg et al, 1992; Ferguson et al, 1999) suggests that individuals' preconceived expectations about mTBI symptoms impact their lived experience, for example, through selective attention towards 'symptoms' that are in line with their expectations (e.g. normal cognitive lapses) and their attribution of these to mTBI, thereby confirming preconceptions. Managing expectations by providing information immediately following mTBI has been found to reduce symptoms reported at 6 months (Comper et al, 2005; Borg et al, 2004; Mittenberg et al, 1996). A 'good old days' bias has also been proposed, where individuals underestimate pre-injury symptoms levels compared to controls, which can impact perceived level of current problems and recovery (Gunstad & Suhr, 2001; Ferguson et al, 1999; Gunstad & Suhr, 2004; Iverson et al, 2010; Lange, Iverson & Rose, 2010).

In addition to the expectation of experiencing symptoms, beliefs around the identity, consequences, timeline, controllability and causal attributions of mTBI have also found to impact the number of symptoms reported by individuals and predict PCS (Snell et al., 2015; Snell et al, 2013; Hou et al, 2012; Var & Rajeswaran, 2012; Snell et al, 2011; Whittaker et al, 2007). The role of injury beliefs in the maintenance of symptoms is further supported by the fact that psychological interventions have proved effective at ameliorating PCS symptoms (Silverberg et al, 2013; Al Sayegh et al, 2010; Mittenberg et al, 1996).

Vanderploeg, Belanger & Koffman (2014) suggest that expectations and beliefs are formed as a result of explicit or implicit messages from contextual factors, such as the media or healthcare providers. Such iatrogenic effects may go some way to explaining the correlation between involvement in litigation and persistent symptoms, as the legal process may provide implicit messages that reinforce illness. Similarly, Spinos et al (2010) found a lower prevalence of PCS

among a Greek population compared to previous literature, and suggested this was due to the contextual difference of culture impacting symptom expectation.

2.4 Stereotype and diagnosis threat

The interaction of contextual factors and beliefs may also contribute to ongoing concussion symptoms via the influence of stereotype threat. Stereotype threat is the phenomenon whereby an individual become at risk of confirming a negative stereotype about a stigmatised group they belong to, owing to being in a situation that triggers negative stereotypic cues (Steele & Aronson, 1995). In such conditions it is hypothesised that the 'threat' of being judged negatively, or conforming to the negative stereotype, can adversely impact individuals' actual performance. Stigmatised group members do not need to personally believe the stereotype (Good, Aronson & Harder, 2000); having an awareness of its existence is sufficient to elicit pressure that can affect performance (Aronson & Good, 2000).

Research into stereotype threat generally employs an experimental paradigm where performance of a group experiencing stereotype threat is compared to a group not experiencing stereotype threat. In the group exposed to stereotype threat, the threat is usually activated by situational cues that draw the relevant stereotype to mind. For example, studies looking into the impact of the stereotype that "older people have poor memories" elicited the stereotype by suggesting older adults would require memory aids (Hess et al, 2003; Hess & Hinson, 2006) or emphasising the memory component of a test (Chasteen et al. 2005).

Although much of the stereotype threat literature has focussed on African Americans, women, and elderly populations, research has now been extended to investigate the effect in health populations. 'Diagnosis threat', as it has been termed, has been found to mediate cognitive performance on neuropsychological tests for a range of health conditions, including pregnancy

(Isgrig, 2010; Suhr & Namitz, 2006), chronic pain (Suhr & Spickard, 2006) and substance use (Cole et al, 2006; Looby & Earlywine, 2010).

Research has found the general population hold negative connotations regarding people that have suffered a brain injury (Linden & Boylan, 2010; McLellan, Bishop & McKinlay, 2010). They also expect cognitive deficits following neurological injury (Linden & Boylan, 2010), even for mTBI (Sullivan & Edmed, 2012c; Mulhern & McMillan, 2006), and sometimes estimate worse difficulties than are usually seen (Dilorio et al, 2004; Ferguson et al, 1999). Such negative stereotypes may be called to mind in neuropsychological testing, for example when task instructions or rationale for testing reminds people of the potential for cognitive deficits.

Research by Suhr & Gunstad (2002; 2005) revealed that in an mTBI population, individuals who had their injury made salient to them before neuropsychological testing performed worse than those who did not. However, the strength of this effect is not clear. Other research has failed to replicate the same level of impact, instead finding a more subtle influence on individual's subjective sense of their test performance, rather than on objective neuropsychological test performance itself (Ozen & Fernandes, 2011; Trontel et al 2013).

2.5 Methodological quality of research

2.5.1 Methodological issues in mTBI literature

Methodological and statistical factors have the potential to confound study results and there are numerous guidance documents from organisations, such as the Cochrane Collaboration, positioned to ensure research is conducted in a systematic way to reduce the impact of such factors. Nonetheless, the addressing of methodological issues has been an area of difficulty in the mTBI literature. The International Collaboration on mTBI Prognosis (ICoMP) highlighted the poor methodological quality of the mTBI research literature, noting that only 28% of studies eligible for the review were accepted as having a low risk of bias (Kristman et al, 2014).

Shortcomings highlighted include a lack of unity around mTBI definitions (and resultant variety in severity delineations); terminology used; bias; poor design; and incomplete reporting. The mTBI literature has also been subject to the phenomena of selection bias, with findings suggesting many studies recruit fundamentally biased samples that are not generalisable to the mTBI population as a whole (Luoto et al, 2012; McCullagh & Feinstein, 2003).

Research into persistent PCS symptoms has been equally complicated by methodological inconsistencies. A methodology and literature review by Satz et al (1999) found a dearth of studies that used appropriate designs to show that mTBI was necessary and / or sufficient to cause PCS symptoms (e.g. the inclusion of an 'other injury' group). Additionally, Iverson (2005) highlights that many studies recruit participants from hospital or Accident & Emergency, which is not a generalisable sample of the mTBI population, as many may not seek medical care. Moreover, he points out that some studies consider endorsement of a single symptom to constitute 'ongoing problems' which, given the non-specificity of PCS symptoms (e.g. headaches, concentration problems), may grossly overinflate estimates of PCS prevalence. Such difficulties are not limited to the presence / absence of symptoms; Sullivan & Edmed (2012a; 2012b; Edmed & Sullivan, 2014) found psychological factors such as the 'expectation as etiology' and 'good-old-days' hypotheses may be partly dependent on methodological aspects such as mode of symptom assessment.

2.5.2 Methodological variation in diagnosis threat literature

Researchers have generally investigated diagnosis threat using a paradigm of comparing test performance of a group experiencing diagnosis threat against that of a group experiencing reduced threat (Kit, Tuekko & Mateer, 2008). Threat is induced via situational cues that elicit negative stereotype activation - in the case of mTBI, that people with a history of mTBI have poor cognitive skills. For example, individuals in the 'diagnosis threat' arm of Suhr & Gunstad's

(2002; 2005) studies were provided with pre-test instructions explaining that the study was looking at cognitive performance in people with a history of head injury, compared to those who don't, as the former have been found to have mild memory difficulties. This capitalised on the stereotype of mTBI sufferers having worse memory and concentration skills. Conversely, individuals in the 'control' arm were told the study was looking at cognitive function in young adults; by avoiding all mention of mTBI, it was hoped that negative stereotypes and ensuing threatening feelings were not activated.

To our knowledge, there has been little investigation into the methodological quality of the diagnosis threat literature. However, it may be reasonable to hypothesise that this area of research is vulnerable to the same methodological shortcomings as the wider mTBI, PCS and stereotype threat literature. For example, varying the terminology used to describe mTBIs (e.g. mTBI, mild head injury, concussion or no diagnosis) influences people's negative illness perceptions (Sullivan, Edmed & Kempe, 2014) and expected injury outcome (Weber & Edwards, 2010). Given these factors have, in turn, been found to impact PCS symptom reports (Whittaker et al, 2007; Ferguson et al, 1999), differing terminology across studies may contribute to variation among results in the diagnosis threat literature.

2.6 Objective

As noted above, there is some evidence of variation in findings across the mTBI diagnosis threat literature, and potential sources for this variation between studies. However, as yet there has been no formal systematic review undertaken to fully summarise the area.

The present review had two aims. Firstly, it sought to identify experimental studies of diagnosis threat in the mTBI population and summarise their findings, in order to gauge whether or not it has an impact on objective neuropsychological assessments. Second, it

aimed to appraise the methodological quality of included studies and any methodological variation amongst them, in order to identify possible factors influencing outcome variation.

3. METHOD

The review was conducted and reported in compliance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

3.1 Literature search

The literature search covered the earliest timeframe available on the relevant electronic databases, through to October 2014. It was conducted using Medline, PsycINFO and SportDISCUS. The full search strategy is listed in *Appendix 1*. The reviewer (SCA) continued to monitor these databases to identify newly published potentially eligible studies from October 2014 until the paper was submitted to the Institute of Psychiatry, Psychology & Neuroscience (IoPPN), King's College London for the partial fulfilment of the degree of Doctorate in Clinical Psychology.

The Cochrane Collaboration advocates searching multiple sources when conducting systematic reviews (Higgins & Green, 2008). Therefore a hand search of the reference lists of papers meeting the eligibility criteria was also conducted to identify any further relevant studies that may have been missed by the electronic search.

At the start of the review it was anticipated that there might be only limited research in this field, and a search of the non peer-reviewed literature (i.e. 'grey' literature) was included. The inclusion of 'grey' literature directly related to the research question regarding possible sources of variation among studies, as it potentially allowed the investigation of methodological rigour and possible publication bias in published versus unpublished work. This

search was done using the electronic grey literature database PsycEXTRA. Authors of relevant studies were also contacted asking if they were aware of any unpublished studies they would be happy to share.

3.2 Eligibility criteria

The literature search identified 1,254 abstracts, which were reviewed using the inclusion and exclusion criteria below:

3.2.1 Inclusion criteria

- English language reports
- Studies involving human participants of all ages
- Studies involving participants reporting a history of mTBI or groups at high risk of mTBI
- Original research manuscripts including published peer-reviewed papers, conference proceedings, meeting abstracts, unpublished manuscripts and dissertations
- Studies with an experimental design that:
 - Manipulated instructions to highlight the presence / absence of mTBI
 - Included objective measures of cognitive function as a study outcome, i.e. neuropsychological tests

3.2.2 Exclusion criteria

- Meta-analyses; systematic reviews; narrative reviews; letters; editorials; commentaries; government reports; books; book chapters; lectures and addresses; and consensus development statements (including guideline statements)
- Cross-sectional studies; case reports; ongoing studies; qualitative studies; and cadaveric, biomechanical, and laboratory studies

- Studies focusing on moderate to severe traumatic brain injury

It was noted that there is a lack of unity among mTBI definitions in the literature, with studies varying between the use of the Glasgow Coma Scale (GCS), loss of consciousness (LOC) and post traumatic amnesia (PTA) (Kristman et al, 2014). Reporting of PTA in particular is often unreliable, especially when made retrospectively (King et al, 1997; Ponsford et al, 2004), which leads to questions around its suitability regarding diagnostic validity. Nonetheless, individual study definition of mTBI was used to determine eligibility for the current review – as opposed to the WHO operational definition – owing to the secondary aim of investigating methodological variation between studies.

3.3 Screening and study selection

At the first level of screening, one reviewer (SCA) read the titles and abstracts of all the citations retrieved from the electronic database searches and removed those that were clearly not related to the research question (e.g. not related to mTBI). This screening yielded 33 potentially relevant papers. The second level of screening involved retrieving full text articles for relevant abstracts. Full texts were reviewed by two independent raters (SCA & HG) for eligibility. No disagreements arose as to the eligibility of a paper. A total of nine papers eligible to be included in the review were identified.

3.4 Data extraction

Data from eligible studies was extracted by the lead researcher and entered into evidence tables using Excel. The data extracted included:

- Study name, authors and publication date

- Journal reference (or publication type if grey literature)
- Study objective and design, including manipulation of test instructions
- Inclusion / exclusion criteria
- Diagnostic criteria (study definition of mTBI), including injury details if reported
- Geographic origin, study setting and recruitment method
- Participant characteristics
- Number and type of outcome measures used
- Analysis and main results

When only partial data was reported, authors were contacted to request more information on the study, although we received no responses to such requests.

3.5 Methodology design coding

For purposes of comparison, inclusion criteria threshold, mTBI definition and test instructions were coded. Inclusion criteria and mTBI definition was defined as ‘high threshold’, ‘low threshold’ or ‘N/A’. For inclusion/exclusion criteria, studies requiring no current *or* historical mental health difficulties and those that had numerous exclusionary criteria (i.e. no medication, no physical health problems) were coded as ‘high threshold’, while those requiring participants to not have a current mental health or neurological diagnosis / ongoing treatment were classed as ‘low threshold’. One study did not report any exclusion criteria; this was coded as ‘N/A’.

For mTBI definition, studies where LOC was a requirement for mTBI criteria were classed as “high threshold”, while those that included participants experiencing both LOC or alterations of consciousness (AOC) were classed as ‘low threshold’. One study involved a high risk population (athletes) rather than an mTBI population; this was coded as ‘N/A’.

Test instructions were an area of potential variation between studies, dependent on how explicitly the link between mTBI and impact on cognitive function was made in them. For the purposes of this literature review, threat level was dichotomised into as 'high threat' or 'low threat'. High threat instructions made an explicit link between mTBI and neuropsychological difficulties, sometimes emphasising a lack of internal control for mTBI sufferers. Conversely, low threat studies provided vaguer instructions, i.e. suggesting difficulties *may* be experienced.

3.6 Quality assessment of the literature

Eligible papers were assessed for methodological quality using modified Scottish Intercollegiate Guidelines Network (SIGN) criteria in order to align with the WHO ICoMP systematic review of mTBI (Carroll et al, 2014).

Section one of the SIGN criteria was used to assess the internal validity of each study using ten questions that covered aspects of selection bias (e.g. randomisation), performance bias (e.g. blinding) and attrition bias (e.g. intention to treat analyses). Each component was rated as 'yes', 'no' or 'can't say'. One SIGN criteria question was omitted from analysis ("Where the study is carried out at more than one site, results are comparable for all sites"), owing to none of the eligible studies being conducted across more than one site.

Rather than using section two of the SIGN criteria, which assesses overall study quality, supplementary items were added in order to better investigate methodological shortcomings raised as particular challenges in mTBI research by Kristman et al (2014). Additional items included:

- Overall sample size and number of participants per arm, in order to look at whether studies had suitable statistical power for their findings

- Steps taken to account for multiple comparisons, (e.g. corrections for multiple comparisons, or condensing multiple test results into single composite scores) in order to look at whether studies have attempted to reduce the risk of making type I statistical errors
- Whether researchers probed participants at the end of the study for suspicion of study hypothesis, in order to investigate accounting for possible threats to construct validity
- Whether incentives for participation were given, which has the potential to impact study integrity (Bentley & Thacker, 2004)
- Testing environment (i.e. location, researcher administering tests), to seek out possible variance in procedure

Sample size and number of comparisons were coded as numbers, whilst other supplementary components were rated as 'yes', 'no' or 'can't say'.

Eligible papers were assessed by two independent reviewers (SCA & HG) and rated on these domains of methodological design and quality. Both reviewers were final year trainee clinical psychologists, who had experience and teaching on systematic review methodology. A consensus method was used to solve disagreements about risk for bias assessment.

3.7 Data analysis

Quantitative synthesis and meta-analysis of the data was beyond the scope of this systematic review. Consequently a narrative synthesis of the data was undertaken.

4. RESULTS

4.1 Search results

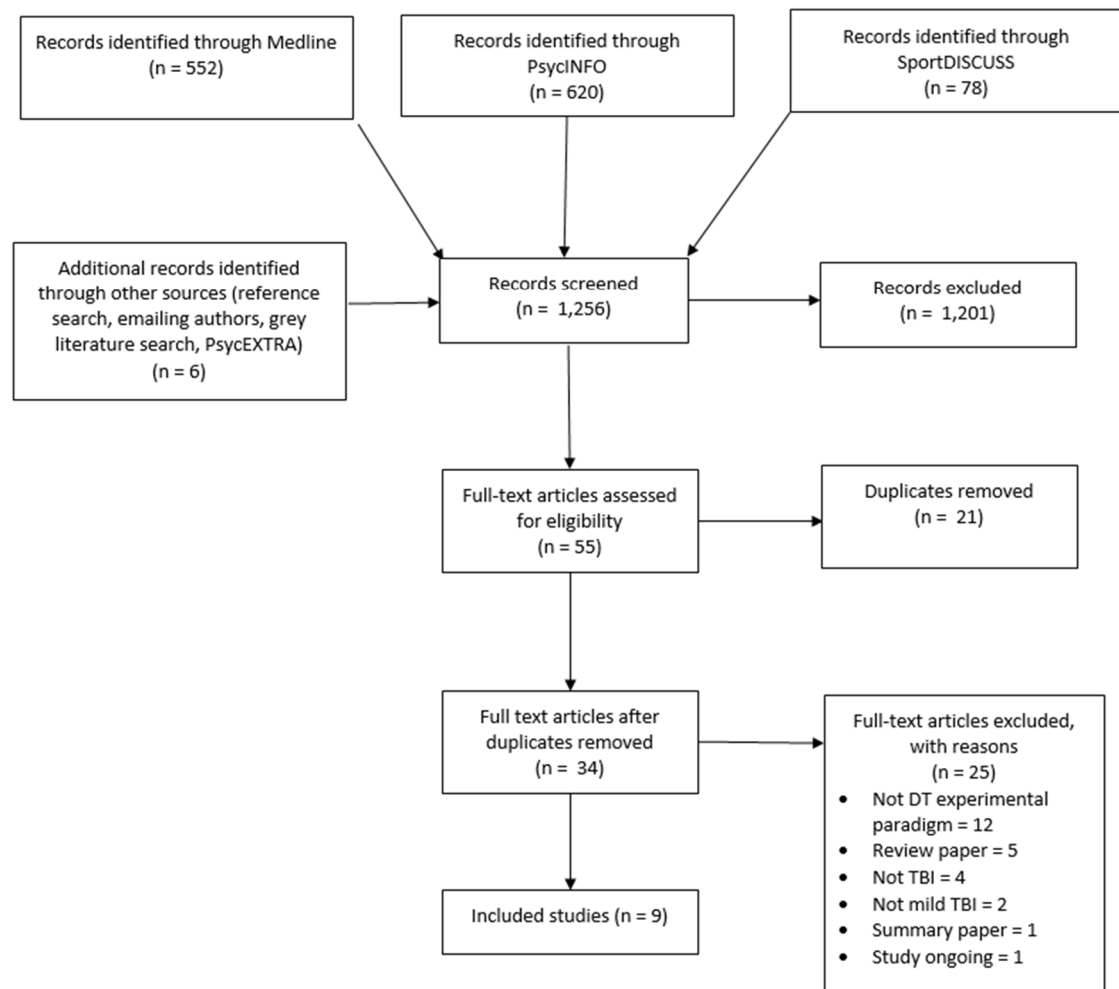


Figure 1. Process for inclusion of studies

The literature search yielded 1,254 abstracts (See *Figure 1*). Once the abstracts were studied, 34 articles were obtained for full review once duplicates had been removed. Of these, ten met the criteria for inclusion; however, one of these was excluded following correspondence with the authors, who confirmed that data collection was ongoing. Therefore, nine studies were included in the systematic review.

The nine articles report findings from experimental studies looking at the phenomenon of diagnosis threat on objective and subjective measures of cognition. All studies used an experimental paradigm whereby task instructions were manipulated by arm.

The majority of studies were published in peer-reviewed journals. Initially, five studies were identified in the 'grey' literature. However on inspection and in the time period between the initial database search and the final search, three of these were found to be published (Pavawalla et al, 2013; Kit et al, 2014; Blaine et al, 2013). Therefore two studies from the 'grey' literature search were included; one dissertation (Kinkela, 2008) and one peer-reviewed conference proceedings publication (Hagler & Yu, 2014).

4.2 Participant characteristics

The majority of participants (7/9 studies) were recruited from a university population. They were notified of the study through their university and screened for eligibility using an online questionnaire. The exception to this was Kit et al (2014), who recruited a clinical sample via neurorehabilitation and psychology clinics, brain injury societies, previous research participants and newspaper advertisements. Screening for eligibility took place via telephone. All but one study (Blaine et al, 2013) was conducted in the United States.

All participants were over 16 years old, with the mean age for most studies falling in the early twenties. Kit et al (2014) was the only study to recruit a considerably older sample (mean age = 38.45). Years of education and gender split was similar across all studies, with a tendency to recruit slightly more females than males, an inverse to the trend generally seen in mTBI prevalence studies (Cassidy et al, 2004). Where reported, average time since injury ranged from 4.1 to 6.3 years.

4.3 Diagnosis threat results

Study	Participants	Experimental manipulation	Neuropsychological measures	DT effect	Measures (N)	% significant	Reported as evidence of DT
Blaine et al (2013)	University undergraduates reporting mTBI	3 experimental conditions: <ul style="list-style-type: none"> • Diagnosis threat • Reduced threat • Neutral 	WAIS-III DS WAIS-III Co WAIS-III SS RAVLT RAVLT Retention Trail Making A Trail Making B COWAT	Yes No No No No No No No	8	13%	No
Hagler & Yu (2014)	NCAA Division III athletes	2 experimental conditions: <ul style="list-style-type: none"> • Diagnosis threat • Neutral 	CCAT Attention CCAT Working memory	No No	4	50%	Yes

			CCAT Memory	Yes			
			CCAT Processing speed	Yes			
Kinkela (2008)	University undergraduates reporting mTBI	2 experimental conditions: <ul style="list-style-type: none"> • Diagnosis threat • Neutral 	WAIS-III DS	No	11	9%	No
			WAIS-III LNS	No			
			WAIS-III Arithmetic	No			
			RAVLT	No			
			RAVLT Retention	No			
			CFT Retention	No			
			WAIS-III Vocabulary	No			
			WAIS-III MR	No			
			WAIS-III BD	No			
			WAIS-III Co	Yes			
			PASAT	No			

Kit et al (2014)	Community members reporting mild-moderate TBI; age-, gender-, matched healthy controls	4 experimental conditions: <ul style="list-style-type: none"> • Diagnosis threat mTBI • Diagnosis threat controls • Reduced threat mTBI • Reduced threat controls 	Attention (ACT, WAIS-III LNS) Initial encoding (RAVLT 1, RBMT) Delayed Recall (RAVLT 6, 7 & Total)	Yes* No No	3	33%	Yes
Ozen & Fernandes (2011)	University undergraduates reporting mTBI; age-, gender-, education- matched healthy controls	4 experimental conditions: <ul style="list-style-type: none"> • Diagnosis threat mTBI • Diagnosis threat controls • Neutral mTBI • Neutral controls 	WAIS-III DSF WAIS-III DSB Trail Making A Trail Making B CVLT	Yes No No No	5	20%	Yes
Pavawalla et al (2013)	University undergraduates reporting mTBI	3 experimental conditions: <ul style="list-style-type: none"> • Diagnosis threat • Gender stereotype threat 	WAIS-III Arithmetic	Yes	1	100%	Yes

		Neutral					
Suhr & Gunstad (2002)	University undergraduates reporting mTBI	2 experimental conditions: <ul style="list-style-type: none"> • Diagnosis threat • Neutral 	Attention (WAIS-III DS, WAIS-III LNS) RAVLT RAVLT Retention CFT Retention WAIS-III Information WAIS-III BD Psychomotor Speed (Trail Making A & B, COWAT)	No Yes Yes Yes Yes No	7	71%	Yes
Suhr & Gunstad (2005)	University undergraduates reporting mTBI	2 experimental conditions: <ul style="list-style-type: none"> • Diagnosis threat • Neutral 	Attention (WAIS-III DS, WAIS-III LNS, WAIS-III Arithmetic) CFT Retention	Yes Yes	9	44%	Yes

			WMT Paired Ass.	Yes			
			WMT Free Recall	No			
			WMT Delayed Recall	No			
			WAIS-III Co	Yes			
			Trail Making A	No			
			Trail Making B	No			
			WCST	No			
Trontel et al (2013)	University undergraduates reporting mTBI	2 experimental conditions: <ul style="list-style-type: none"> • Diagnosis threat • Neutral 	WAIS-III DS	No	9	11%	No
			WAIS-III LNS	No			
			CVLT	No			
			CVLT Retention	No			
			WAIS-III Information	Yes			
			WAIS-III BD	No			
			WAIS-III Co	No			
			Trail Making A	No			

			Trail Making B	No			
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Table 1. The effect of diagnosis threat on neuropsychological test outcomes in mTBI sufferers

* Significant difference between diagnosis threat arm and reduced threat arm. No significant main effect was found between diagnosis threat and neutral arm

DSF=Digit Span forwards, DSB=Digit Span backwards, CVLT=California Verbal Learning Task, DS=Digit Span, Co=Digit-Symbol Coding, SS=Symbol Search,

RAVLT=Rey Auditory Verbal Learning Test, COWAT=Controlled Oral Word Association Test, ACT=Auditory Consonant Trigrams, LNS=Letter-Number

Sequencing, RBMT=Rivermead Behavioural Memory Test, CFT=Complex Figure Test, BD=Block Design, WMT=Word Memory Test, WCST=Wisconsin Card

Sorting Test, MR=Matrix Reasoning, PASAT=Paced Auditory Serial Addition Test, CCAT=Cogstate Computerized Cognitive Test Tool

4.3.1 *Diagnosis threat findings on neuropsychological tests*

A summary of study results can be found in Table 1. Neuropsychological tests or composite measures were judged to have shown a diagnosis threat effect if effect sizes were found to be statistically significant at $p < 0.05$. All studies found an impact of diagnosis threat on at least one neuropsychological task. However, studies varied as to whether they reported this as evidence for diagnosis threat or not. Percentage of significant findings varied widely across studies, though as a rule if significant findings comprised less than 20% of total cognitive tasks administered, studies concluded there was not sufficient evidence for a diagnosis threat effect.

Studies used a range of neuropsychological tasks, with subtests of the Weschler Adult Intelligence Scale, 3rd Edition (WAIS-III) being most commonly employed. The most consistent impact was found for attention / working memory tasks (e.g. WAIS-III Digit Span, Letter-Number Sequencing, Arithmetic); all studies included some form of working memory task, with five studies finding a significant effect of diagnosis threat (Suhr & Gunstad 2005; Pavawalla et al, 2013; Kit et al, 2014; Ozen & Fernandes, 2010; Blaine et al, 2013). Deficits were also found in some studies for processing speed (Suhr & Gunstad, 2005; Hagler & Yu, 2014; Kinkela, 2008 – although the latter reported a null finding owing to results not being significant at $p = 0.01$.), delayed recall (Suhr & Gunstad, 2002; 2005; Hagler & Yu, 2014), information-based tasks (Trontel et al, 2013; Suhr & Gunstad, 2002;) and perceptual tasks (Suhr & Gunstad, 2002).

4.3.2 *Diagnosis threat findings for subjective and self-report measures*

Select studies also investigated the impact of diagnosis threat using subjective measures and symptom report. Those that investigated these aspects found an impact on self-reported memory (Ozen & Fernandes, 2010; Kit et al, 2014), attention (Ozen & Fernandes, 2010) and

academic self-efficacy (Trontel et al, 2013), but not on neurobehavioral symptoms (Blaine et al 2013; Kit et al, 2014; Pavawalla et al, 2013).

4.3.3 Moderating or mediating factors

Some studies also investigated variables that may potentially moderate or mediate diagnosis threat. Mood and anxiety outcomes were mixed; out of five studies investigating these factors, two found a significant impact of diagnosis threat on anxiety (Ozen & Fernandes, 2010; Kit et al, 2014). Two of three studies investigating effort (Kit et al, 2014; Suhr & Gunstad, 2002) found those in diagnosis threat arms reported investing less effort. Two studies directly investigated potential mediators of the diagnosis threat effect. The first (Pavawalla et al 2013) found concussion identity mediated the impact of diagnosis threat, while another failed to find an impact for evaluation vulnerability (Kinkela, 2008).

4.4 Methodological variation

Study	Inclusion criteria threshold	mTBI definition threshold	Study design		
			Testing environment	Non-mTBI control group	Instruction Threat
Blaine et al (2013)	Low	Low	Individual	No	High
Hagler & Yu (2014)	N/A	N/A	Group	N/A	Low
Kinkela (2008)	High	Low	Individual	No	Low
Kit et al (2014)	Low	High	Individual	Yes	High
Ozen & Fernandes (2011)	Low	High	Individual	Yes	Low
Pavawalla et al (2013)	High	Low	Group	Yes	Low
Suhr & Gunstad (2002)	Low	High	Individual	No	High
Suhr & Gunstad (2005)	Low	High	Individual	No	High
Trontel et al (2013)	Low	High	Individual	No	High

Table 2. Areas of methodological variation across studies

4.4.1 Inclusion / Exclusion criteria

Inclusion and exclusion criteria varied across studies. Hagler & Yu (2014) was the only study to not require participants in the experimental arm to report a history of mTBI, instead recruiting a 'high risk' population of National Collegiate Athletic Association (NCAA) Division III athletes. Of those studies recruiting an mTBI population, two studies (Blaine et al, 2013; Pavawalla et al, 2013) required three months to have passed since the injury, in line with research stating PCS symptoms within a three month period should still be seen as within normal recovery range (Bigler, 2008). Three studies stipulated that six months must have passed since injury (Ozen & Fernandes, 2010; Kit et al, 2014; Kinkela, 2008). The remainder (four) did not report any minimum requirement.

Only one study specified a maximum time since injury (Pavawalla et al, 2013) of 60 months. Most studies excluded participants on the basis of psychiatric illness, substance abuse or neurodevelopmental disorders.

Other exclusion criteria included comorbid physical health conditions (Kinkela, 2008); poor English language proficiency (Ozen & Fernandes, 2011; Blaine et al, 2013); current litigation (Kit et al, 2014; Kinkela, 2008); effort, as measured by the Test of Memory Malingering [TOMM] (Blaine et al, 2013); poor hearing or vision (Ozen & Fernandes, 2010); and medication (Kinkela, 2008). Overall, there did not appear to be a relationship between inclusion criteria stringency and study outcome.

4.4.2 Diagnostic criteria, including injury details

Most (6/9) studies used the definition of mTBI provided by the American Congress of Rehabilitation Medicine (ACRM) (Kay et al, 1993), although Ozen & Fernandes (2010) made criteria more stringent by stipulating that LOC must be present. Those that did not use the

ACRM definition (Suhr & Gunstad, 2002; 2005; Trontel et al, 2013) all defined mTBI as “a strike to the head that resulted in a LOC of less than 30 mins”. One study (Hagler & Yu, 2014) recruited a ‘high risk’ population (i.e. contact sports players), irrespective of whether they reported a history of mTBI and one study included participants with both mild and moderate TBI (Kit et al, 2014); those with the latter diagnosis comprised less than 25% of the study sample.

All studies used self-report of symptoms to gauge eligibility and none reported how injury markers such as LOC and post traumatic amnesia (PTA) were evaluated. Overall, there did not appear to be a relationship between mTBI diagnostic criteria and study outcome.

Only two studies reported mechanism of injury (Blaine et al, 2013; Kinkela, 2008). Kinkela (2008) reported sport injuries, falls, vehicle accidents, head hitting object and anoxia, while Blaine et al (2013) reported injuries as sport or non-sport related.

4.4.3 Study design

Three studies compared mTBI participants to healthy controls (Ozen & Fernandes, 2010; Kit et al, 2014; Pavawalla et al, 2013) and as a result had four study arms (diagnosis threat and neutral / reduced threat arms for both mTBI and healthy controls). Five studies had two experimental arms (diagnosis threat and neutral), with the remainder (Blaine et al, 2013), randomising participants to diagnosis threat, reduced threat or neutral arms.

4.4.4 Threat manipulation

All but one study used the content of written test instructions to manipulate diagnosis threat. The exception to this was Kinkela (2008), who showed participants in the diagnosis threat arm a video about brain injury and those in the control arm a video about the eye. In all studies,

‘diagnosis threat’ instructions highlighted participants’ past mTBI and linked mTBI history with memory and attention difficulties; ‘neutral’ instructions stated studies were looking into memory and attention of young adults, or made no reference to participant characteristics. Where ‘reduced threat’ arms were used, these highlighted the likelihood of full recovery of memory / attention difficulties following mTBI.

Strength of diagnosis threat cues (i.e. test instructions) varied widely across studies, from explicitly listing possible cognitive deficits experienced after mTBI (Suhr & Gunstad, 2002; 2005; Trontel et al, 2013) or highlighting lack of personal control (Blaine et al, 2013) to more vague, subtle manipulations (Ozen & Fernandes, 2010; Pavawalla et al, 2013) e.g. suggesting mild difficulties on “some types of tasks, but not others”. Despite the finding in previous literature that even subtle manipulations of task instructions can differentially impact test performance (Kit et al, 2008), type and strength of threat cue did not appear related to study findings.

Two studies (Pavawalla et al, 2013; Hagler & Yu, 2014) utilised a group format where participants self-administered tasks, while the remainder employed a one-to-one testing environment.

4.5 Methodological quality

Study	Clear Question	Random allocation	Concealed allocation	Blind Subjects	Equal arms start	Arms treated similarly	Valid outcome measurements	Attrition	ITT
Blaine et al (2013)	Yes	Yes	Yes	Yes	Yes	No (task order varied)	Yes	N = 0	Yes
Hagler & Yu (2014)	Yes	Yes (quasi-randomisation)	No	Yes	Not reported	Yes	No (STAI, PANAS not reported)	N = 0	Yes
Kinkela (2008)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	< 20% excluded	No
Kit et al (2014)	Yes	Yes (constrained randomisation)	No	Yes	No (premorbid differences)	Yes	No (MIA not reported)	>20% excluded	Yes
Ozen & Fernandes (2011)	Yes	Not reported	No	Yes, but method unclear	Yes	No (task order varied)	Yes	Not reported	Not reported

Pavawalla et al (2013)	Yes	Yes	Not reported	Yes, but method unclear	Yes	Yes	Yes	>20% excluded	No
Suhr & Gunstad (2002)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not reported	Yes
Suhr & Gunstad (2005)	Yes	Yes	Yes	Yes	No (mean age differences)	Yes	Yes	Not reported	Yes
Trontel et al (2013)	Yes	Yes	Not reported	Yes, but method unclear	Yes	Yes	Yes	< 10% excluded	Yes

Table 3. Methodological quality of included studies – SIGN Section 1 checklist for internal validity for controlled trials

MIA=Metamemory in Adulthood questionnaire, STAI=State-Trait Anxiety Inventory, PANAS= Positive & Negative Affect Schedule

Study	Sample size (N)	Arm size (N)	Measures used (N)	Domains reported (N)	Suspicion probe	Same testing location	Same investigator	Incentive
Blaine et al (2013)	45	15	8	8	Not reported	Not reported	Not reported	Yes
Hagler & Yu (2014)	23	12	4	4	Not reported	Yes	N/A (self-administered)	Not reported
Kinkela (2008)	32	16	11	7	Not reported	Not reported	No	Yes
Kit et al (2014)	84	21	7	3	Not reported	Not reported	Not reported	Not reported
Ozen & Fernandes (2011)	87	22	5	5	Not reported	Not reported	Not reported	Yes

Pavawalla et al (2013)	204	51	1	1	Not reported	Yes	N/A (self-administered)	Yes
Suhr & Gunstad (2002)	36	18	10	4	Not reported	Not reported	Not reported	Yes
Suhr & Gunstad (2005)	53	27	11	4	Not reported	Not reported	Not reported	Yes
Trontel et al (2013)	49	25	9	4	Not reported	Not reported	Not reported	Yes

Table 4. Methodological quality of included studies – Supplementary items

A summary of the assessment of susceptibility to bias for included studies is provided in *Table 3*, whilst a summary of the supplementary items pertaining to methodological quality can be found in *Table 4*.

All studies addressed an appropriate and clearly focused question, a key requirement in evidence based medicine (Akobeng, 2005). However, a number of studies appeared to breach some internal validity measures.

All but one study (Ozen & Fernandes, 2011) explicitly reported random allocation of individuals to study arms. However, only two studies (Kit et al, 2014; Hagler & Yu, 2014) stated the process of randomisation used. One study (Blaine et al, 2013) used constrained randomisation to ensure experimental and control arms were matched for age and gender and one study (Hagler & Yu, 2014) employed a quasi-random design, where allocation was based on order of entrance to the testing lab.

Four studies reported concealing group allocation (Blaine et al, 2013; Suhr & Gunstad, 2002; Suhr & Gunstad, 2005; Kinkela, 2008), although one did not explain the process for doing so, instead reporting a non-significant correlation between actual condition and examiner-predicted condition (Kinkela, 2008). Allocation concealment for the remaining studies was either not reported or not possible owing to study design. All studies reported blinding of participants, although three failed to detail blinding method (Ozen & Fernandes, 2011; Pavawalla et al, 2013; Trontel et al, 2013).

All but one study (Hagler & Yu, 2014) included preliminary analysis on background measures (e.g. age, years of education), with two studies finding significant group differences at baseline. Kit et al (2014) found significant differences in Brief Symptom Inventory (BSI) and North American Adult Reading Test (NAART) scores; follow-up analyses was conducted using both scores as covariates, and re-running analyses without their inclusion and no differences in outcomes were noted. Suhr & Gunstad (2005) found a significant age difference between

arms, but reported that the age range in the population was not large and that age did not correlate significantly with any of the neuropsychological measures.

In two studies groups were treated differently beyond experimental manipulation (Ozen & Fernandes, 2011; Blaine et al, 2013). In both cases this difference was the order in which tasks were completed, which was a result of the study design chosen. All studies used valid neuropsychological outcome measurements, although two studies did not report some secondary outcomes (Kit et al, 2014; Hagler & Yu, 2014).

As studies only covered one time period, there were few losses to follow-up. However, four studies retrospectively excluded participant data owing to exclusion criteria (Kit et al, 2014; Trontel et al, 2013; Kinkela, 2008) and experimental glitches (Pavawalla et al, 2013); for half this comprised a substantial percentage of the study population (>20%). Two studies did not include dropouts in the final analysis (Pavawalla et al, 2013; Kinkela, 2008). In addition, three studies did not report attrition (Ozen & Fernandes, 2011; Suhr & Gunstad, 2002; Suhr & Gunstad, 2005) and one did not report ITT analysis (Ozen & Fernandes, 2011).

Sample sizes varied considerably overall (range 23 to 204), although the majority (8/9) had similar sized groups of 12-27 participants per arm, so it was difficult to examine an impact of study power on results. The other study with the largest N per arm (51) did show a diagnosis threat effect. Four studies did not condense their data; three investigated a small number of neuropsychological tests (Hagler & Yu, 2014; Ozen & Fernandes, 2010; Pavawalla et al, 2013 – see *Table 4*) and one (Blaine et al, 2013) addressing multiple comparisons statistically using a Bonferonni-adjusted alpha.

No studies reported conducting a post-experimental enquiry as to whether participants guessed the true nature of the research, nor did most report whether tester and testing location remained uniform across participants. Two studies did not report whether

participants were offered incentives to take part (Kit et al, 2014; Hagler & Yu, 2014); the remaining studies all offered incentive to participants, most frequently course credits.

5. DISCUSSION

This review comprised two parts; the first examined nine studies to ascertain whether there is an effect of diagnosis threat on neuropsychological test performance in an mTBI population. The second part further analysed studies to consider aspects of methodological variation and quality which might explain outcome differences between studies. Several issues of interest arose from the review.

5.1 Impact of diagnosis threat

A review of the literature found that there is evidence that diagnosis threat had a direct impact on performance on neuropsychological tests. However, there was wide variation across studies as to the number of significant findings and the cognitive domain in which they were found. This suggests the threat effect may be smaller or more variable than previously reported, and it remains unclear as to which cognitive domains are impacted by diagnosis threat.

The most robust finding was that tasks involving attention / working memory were affected by diagnosis threat, with five studies reporting a significant effect on such tasks (Suhr & Gunstad 2005; Pavawalla et al, 2013; Kit et al, 2014; Ozen & Fernandes, 2010; Blaine et al, 2013). One possible reason that these tasks appear most sensitive to threat manipulation is the idea that they require a greater degree of effortful processing (Kit et al, 2014) compared to some other tasks (e.g. delayed recall). Research into mTBI has suggested that cognitive deficits can be relatively subtle and may only be detected on tasks that tax cognitive processing resources (Bernstein, 2002; Cicerone, 1996). Findings for other cognitive domains were more variable,

which is in line with the wider literature on neuropsychological functioning following mTBI (Karr et al, 2014). This also reflects recent research in the wider stereotype threat literature, which has suggested that threat effects may be small but significant (Flore & Wicherts, 2014) and only impact some cognitive domains (Thames et al, 2013). Additionally, the integrated process model of stereotype threat suggests that threat response reduces individuals working memory capacity, which in turn impacts performance on other cognitive tasks (Schmader, Johns & Forbes, 2008; Schmader & Johns, 2003), suggesting this cognitive domain is more sensitive to stereotype threat.

Comparison of studies was difficult owing to the heterogeneity of outcome measures used and different authors categorising the same neuropsychological tests as different cognitive domains. For example, the WAIS Digit Span task was reported under the Attention domain in some studies and the Memory domain in others. A meta-analysis by Karr et al (2014) noted a similar shortcoming of research in the mTBI literature field relating to potential variation in how different neuropsychological assessments are classified by domain.

Subtler influences of diagnosis threat may also be relevant, either in terms of subjective views of performance or qualitative approaches to assessment. Ozen & Fernandes (2010) found that their diagnosis threat group reported significantly more day-to-day memory and attention lapses, while Hagler & Yu (2014) found those in the diagnosis threat arm did not perform less accurately than controls, but did have significantly longer response times. They suggested that when faced with diagnosis threat participants may have employed a more cautious cognitive style (i.e. hesitating, second-guessing and double checking their responses). This theory is supported by research by Seibt and Forster (2004) and Ozen & Fernandes (2012). The latter looked specifically at people with a history of mTBI and found them to employ the strategy of delaying their responses in order to maintain accuracy on cognitively demanding tasks, even

when steps were taken to reduce diagnosis threat. Such strategies may prove to have an influence on neuropsychological tasks, particularly those with time limits.

5.2 Methodological differences

No clear associations emerged regarding links between the presence of diagnosis threat effects and methodological differences. None of the investigated factors – inclusion criteria, mTBI diagnostic criteria or study design – showed a clear relationship with study findings.

One reason for this may be that despite variation in inclusion criteria and mTBI definition, most of the studies ended up looking at remarkably similar population samples. Although criteria across studies varied, most excluded participants with mental health difficulties and neuropsychological disorders. Similarly, although studies varied as to whether LOC was a necessary symptom for mTBI definition (and therefore inclusion), even those that used the former, more stringent diagnostic criteria ended up with participants at the mild end of the mTBI spectrum. For example, Ozen & Fernandes (2010) reported average duration of LOC as 2 minutes (compared with the usual ceiling of 30 for mTBI). Given that all but one study was already recruiting from a university student sample, it appears that most ended up investigating a similar, homogenous population. It is possible that if there had been wider variation within studies, differences in mTBI criteria may have been more pronounced.

The employment of university students as the primary source of participants in most included studies may have impacted outcomes. Instead of activating 'mTBI' stereotype beliefs, the academic nature of the study content may have activated 'student' stereotype beliefs, including positive beliefs about cognitive ability. Given participants were attending university at the time, it is likely that student identity would be more accessible and more relevant, and its activation may have impeded mTBI identity activation. This has been demonstrated in

stereotype literature, where maths performance improved for Asian women who had their identity as Asians activated as opposed to their gender (Shih et al, 2002).

Although homogenous in some aspects, study populations may have been extremely heterogeneous in others, with potentially significant data not always collected. Only one study (Pavawalla et al, 2013) placed limits on time since injury in their inclusion criteria, while only two (Blaine et al, 2013; Kinkela, 2008) reported injury type. These factors were therefore hard to compare across the research. This is important as it is possible that if there was a wide range of individual differences, it may have impacted study findings, and should be at least measured in future studies. It is reasonable to think that such factors may correlate with potential moderators of diagnosis threat: regarding length of time since injury, quite apart from the possibility of residual effects of injury (which may be more likely within the first 3-6 months), relative recency of injury may also make it easier to activate diagnosis threat.

Steele, Spencer & Aronson (2002) state that the strength of stereotype threat is partly dependent on the negative meaning of the stereotype. Research has found that athletes often do not view mTBI as a serious concern (Miyashita et al 2014; Bloodgood et al, 2013) and it has been suggested that, in general, people view sports concussion injuries in a less negative way compared to other injury mechanisms, such as a road traffic accidents (Blaine et al, 2013). This may be owing to the differing responses often required to differing injury mechanisms. For example, only a minority of sport concussions require hospitalisation (McCrory et al, 2009), which may not be the case with other injury mechanisms. As a result, participants may not hold overly negative perceptions of sports-related mTBI, seeing them as less severe, which would affect the degree of diagnosis threat experienced when alerted to their history of mTBI.

Steele, Spencer & Aronson (2002) also note that identification with the stereotyped group is an important moderator of stereotype threat, one that may have been impacted by variation in individual differences. In mild cases of mTBI (the kind seen in the majority of included studies) it is unlikely that participants' mTBI status comprised an important part of their identity. Equally, those reporting their injury as being a long time ago may view it as less personally relevant. Additionally, individuals may have had more opportunities to experience situations incongruent with negative mTBI stereotypes (Blaine et al, 2013).

With regard to study design, Steele, Spencer & Aronson (2002) point out the need for the experimental design to adequately activate stereotype threat. Few studies included a method for testing this, although Blaine et al (2013) suggested that their null results may have been owing to only 46% of participants remembering details of task instructions, while Kinkela (2008) reported qualitative feedback that several participants in the debrief noted that they were too concerned about passing the lecture post-test to think about their own head injury. Such suggestions may go some way to explaining the difference in outcome between studies using the same test instructions.

Additionally, although test instructions varied in terms of the explicitness with which possible cognitive deficits were highlighted, few investigated other aspects of test instruction manipulation. For example, Ozen & Fernandes was the only study to include an explicit statement that results would be compared with healthy controls. Such manipulations have been found to have an impact in the more general stereotype literature (Kit et al, 2008). However, the clinical utility of investigating such avenues may be questioned – explicit lists of cognitive symptoms are usual in a concussion screening, whereas explicit comparisons to healthy populations may not be as common in a clinical setting.

In spite of the relative simplicity of experimental designs, outcomes of the current review again mirror the wider stereotype threat literature, where the employment of a wide range of methodologies has led to difficulties drawing clear conclusions around contributing mechanisms (Kit, Tuokko & Mateer, 2008). Reviews and meta-analyses of the stereotype threat literature have found methodological differences contribute to the strength of stereotype threat detected in different studies. Methodological limitations highlighted by these reviews include studies lacking an adequate non-stereotyped control group to improve confidence that findings can be attributed to stereotype threat (Stoet & Geary, 2012), failure to replicate findings (Ganley et al, 2013) and publication bias (Flore & Wicherts, 2015; Ganley et al, 2013). Nguyen & Ryan (2008) suggest that inconsistency in how test difficulty is operationalised in the literature contributes to variation across study results in stereotype threat literature on women and minorities. Similarly, Lamont, Swift & Abrams (2015) found that stereotype-based manipulations (e.g. “it is widely assumed that intellectual performance declines with age”) caused greater performance decrements than fact-based manipulations (e.g. “past research has shown that memory performance declines with age”). However, results are mixed; a metaanalysis by Nadler & Clarke (2011) found no difference between the use of explicit stereotype cues (e.g. mentioning stereotype-based expectations and implicit cues (e.g. making race salient) in African Americans and Hispanic American populations.

5.3 Methodological quality

Methodological quality was assessed by looking at measures taken by studies to ensure internal and external validity of design, conduct and analyses. Although potential sources of variation were identified, there appeared to be little variation across studies with regard to reporting internal validity. There was no difference in methodological quality between published and grey literature. Given there was a mix of significant and null findings in both the published and unpublished research, this suggests there is not a publication bias in the

diagnosis threat literature. There was also no obvious link between quality of the study and outcome.

5.4 Limitations

Although efforts were taken to be thorough, the current literature review is not without its limitations. The review only included English language reports, which may lead to a cultural bias or inaccurate representation of the research area as a whole.

Attempts to contact authors about possible unpublished studies and clarification of study method when details were unclear were made; however we received few responses.

Therefore, some grey literature may have been missed. Similarly, the lack of contact means that aspects of study methods assigned a high risk of bias may reflect quality of reporting rather than quality of methods used.

The SIGN quality assessment tool employed in the study is one that has been used in the wider literature. However, there is no 'gold standard' tool to assess risk of bias and a component approach is the most meaningful way to approach such questions, as different aspects of study quality may not contribute equally. Additionally, as with most quality assessment tools, SIGN focuses on internal rather than external validity, which means it may overlook some sources of bias (e.g. selection bias). This is important given that lack of generalisability was a factor highlighted by both this review and many of the studies included in it. A lack of external validity reporting is one of the main criticisms of systematic reviews and one of the main reasons clinicians cite for not following recommendations made by them (Rothwell, 2004).

The objective of the current review was to investigate the presence / absence of evidence for an effect of diagnosis threat. Although beyond the scope of the current review, it has been

highlighted that the data would lend themselves to statistical analysis and a study into effect sizes across the literature would be informative. Undertaking a systematic review or meta-analysis would raise methodological difficulties regarding the heterogeneity of outcome measures used and inconsistency around operational definitions of cognitive domains. Nonetheless, meta-analysis would allow the degree of conflict between study findings be more rigorously assessed, enabling further exploration and quantification of reasons behind the variation in the literature. Such difficulties are faced by reviews of mTBI literature in general (Karr et al, 2014). This field of research may be able to provide a framework for how to best to proceed with a meta-analysis on diagnosis threat and benefit from synthesising the existing research in a communicative and meaningful way.

5.5 Future research

5.5.1 Theoretical implications

Many of the included papers propose that variation among study findings may be owing to differing manipulations of mechanisms involved in diagnosis threat. For example, Pavawalla et al (2013) suggests that Ozen & Fernandes' (2010) limited findings on neuropsychological test measures may be related to the lack of assessment of group identification (i.e. identification with being concussed). A number of studies within the review investigated possible moderating factors such as depression, anxiety, effort (Suhr & Gunstad, 2005), self-efficacy (Kit et al, 2014; Trontel et al 2013) and concussion identification (Pavawalla et al, 2013). However, further investigation into theoretical models of mechanisms in diagnosis threat are needed. Possible mechanisms and moderators that have yet to be investigated and may potentially be relevant include illness perceptions (Leventhal, Nerenz & Steele, 1984), locus of control and related coping (Folkman, 1984) and personality factors such as suggestibility (Spiegel, 2007).

Collecting information on participants' experience of threat may be valuable in order to be more confident in attributing findings specifically to diagnosis threat. This is a research avenue that has not been extensively investigated in the stereotype literature, possibly owing to difficulties in measuring an effect that is often hypothesised as not consciously accessible to individuals (Kit et al, 2008), and the need to shield participants from the experimental hypotheses, at least prior to and during the experimental procedure.

Further investigation of more subtle influences of diagnosis threat should also be investigated. Those studies that did find a significant impact of diagnosis threat on subjective measures have posited different reasons for this, ranging from psychological factors – such as inaccurate self-efficacy beliefs leading individuals to put forth less effort (Ozen & Fernandes, 2010; Trontel et al, 2013) – to subtle drops in neural processing efficacy (Ozen & Fernandes, 2010). More research is needed to replicate and explore these options.

Although there was no clear difference in quality found between published and 'grey' literature, comparisons were limited as much of the 'grey' literature was subsequently published, leaving a small number of 'grey' studies to compare.

5.5.2 Methodological implications

As mentioned earlier in the review, the assessment of risk of bias for some studies may be more a reflection on the quality of the information about the methods reported rather than methodological quality. Nonetheless, some methodological recommendations for future studies can be made (see *Table 5*). It is important that future studies clearly report steps taken to reduce bias, to assure readers of the validity of their findings and enable replication studies to be undertaken.

Future studies should aim to replicate results of the reviewed studies using a larger sample size; many of the studies included in the current review cited small sample size as a study limitation or reason for null findings. Similarly, the majority of the studies in the review are limited in generalisability owing to exclusively recruiting university students (Ozen & Fernandes, 2010; Blaine et al, 2013; Suhr & Gunstad, 2002; 2005; Pavawalla et al, 2013; Trontel et al, 2013; Hagler & Yu, 2014). Although recruitment methods may have meant that studies were able to capture mTBI sufferers who do not present at hospital, future research should attempt to replicate findings in a community-based sample. The ethical implications around imposing diagnosis threat on individuals already concerned about their cognitive performance preclude the use of a clinical sample.

Most studies relied solely on self-report of mTBI – which have been found to often be inaccurate (Kerr et al, 2015; Robbins et al, 2014) – without seeking verification. Although difficult, future studies might investigate using other screening measures alongside subjective reports for verification (e.g. healthcare notes, sports match reports).

Some studies from the wider stereotype threat literature suggest that healthy controls can be negatively impacted by stereotype threat, even when they are part of the ‘non-stereotyped’ group, and that a healthy control arm should be included be able to attribute any group differences to stereotype threat (Wheeler & Petty, 2001). This is something future studies on diagnosis threat may wish to consider, although the impact of diagnosis threat in mTBI remains an area of clinical interest irregardless of whether it is unique to the at-risk stereotyped group.

Given the difficulties presented by heterogeneous grouping of neuropsychological tests into cognitive domains, researchers may consider alternate ways of analysing and presenting their

findings, for example reducing the number of tests investigated, prioritising analyses or correcting for multiple comparisons as opposed to not condensing the data.

Area of variation	Recommendations
mTBI diagnosis	<ul style="list-style-type: none"> • Clearly defined definition of mTBI, compatible with WHO Task Force • Diagnosis supported by multiple information sources (e.g. self-report, healthcare notes, sports clinician reports) • Clear use and reporting of valid measurement tools of injury markers
Inclusion criteria	<ul style="list-style-type: none"> • Record length of time since injury, and consider using upper and lower limits , to avoid zero-time bias • Wider community sample (rather than undergraduates), including participants with previous / current mental health diagnoses, to improve external validity • Documentation of and / or study design accounting for possible confounds (e.g. alcohol intake, comorbidities)
Study design	<ul style="list-style-type: none"> • Test instructions that reflect information provided to patient in clinical settings, to improve external validity and make results more clinically meaningful • Consider inclusion of a healthy control group, dependent on study hypothesis, in order to improve confidence in attributing findings to diagnosis threat
Study bias	<ul style="list-style-type: none"> • Realistic power calculations and recruitment of adequate sample size • Documenting characteristics of participants who chose not to take part or dropped out, to better gauge selection bias • Clear reporting of steps taken to reduce risk of bias

	<ul style="list-style-type: none"> • Appropriate study design to reduce sources of bias (e.g. ensuring researcher blinding) • Inclusion of a suspicion probe to check whether participants aware of true study hypothesis
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Table 5. Recommendations for researchers designing and conducting studies of diagnosis threat in mTBI

5.6 Clinical implications

The presence of stereotype threat remains a challenge in clinical settings, given that individuals will be aware of their mTBI and the reason for undertaking neuropsychological testing. However, clinicians should be aware and take into account the variation of knowledge and expectations surrounding mTBI in the general population. Particular thought may be given when conducting tests of attention / working memory, given that they appear more sensitive to the effect of diagnosis threat.

6. CONCLUSION

The current review suggests that there is evidence for the impact of diagnosis threat on neuropsychological test performance in individuals with a history of mTBI, especially in the area of attention and working memory. However, there is considerable heterogeneity in outcomes across studies, suggesting the effect may be weaker or more variable than was expected.

The sources for this variation between studies were not clear from the review: aspects of study methodology and quality did not appear to have a clear impact on study outcomes from an obvious narrative viewpoint. It is possible that a more quantitative approach might indicate these effects more clearly, although limitations in data collected (such as length of time since injury) may limit the scope of these analyses. However, these findings are consistent with the

wider stereotype threat literature, where failures to replicate are not uncommon. The results of diagnosis / stereotype threat studies may be influenced by numerous factors that may have a cumulative effect, and which may have varying influences across different groups and different situations. Future research needs to clarify individuals' perception of threat and investigate the more subtle influences of diagnosis threat on people with a history of mTBI.

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8. APPENDIX

8.1 Appendix 1. Database Search String

mild traumatic brain injury OR mTBI OR acute brain injury OR brain contusion OR diffuse brain injury OR focal brain injury OR traumatic brain injury OR brain laceration* OR cortical contusion OR TBI OR concuss* OR head injur* OR brain injur* OR Head injur* OR *concuss* OR mild head injury OR mild head injury OR MHI OR head trauma

AND

Diagnosis threat OR Nocebo OR Stereotype threat OR [[Expectat* OR Assumpt* OR Belief*]
AND [cognitive performance OR cognitive ability OR cognitive assessment OR cognitive tasks
OR cogni* OR neuropsych*]] OR Priming OR Suggestib*

Part 2

EMPIRICAL RESEARCH PROJECT

Diagnosis threat and injury beliefs after mild traumatic brain injury

Samantha Carter-Allison

Institute of Psychiatry, King's College London

Supervised by:

Dr Sebastian Potter

Dr Katharine Rimes

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1. ABSTRACT

Background: Diagnosis threat is a psychosocial factor that has been proposed to contribute to poor outcomes following mild traumatic brain injury (mTBI). Despite increased research into the phenomenon in recent years, there remains uncertainty as to the existence and strength of the phenomenon, with heterogeneity between study results. The current study aimed to replicate past findings of a diagnosis threat effect on neuropsychological test performance and self-report of cognitive difficulties in a 'high risk' population of athletes, in order to provide greater clarity to the area and improve generalisability of findings. It also investigated two possible moderators of diagnosis threat – injury beliefs and suggestibility – to see whether they could potentially explain the heterogeneity seen in the literature.

Method: Seventy-six participants with a history of mTBI were recruited through rugby and boxing clubs. Participants were randomised to a diagnosis threat group, where study instructions drew awareness to their past mTBI, or a control group, where instructions made no mention of mTBI. They were then asked to complete a neuropsychological battery of working memory / attention and processing speed tasks, and complete questionnaires regarding day-to-day cognitive errors. Measures of depression, anxiety, illness beliefs and suggestibility were also collected.

Results: No significant group differences on any neuropsychological tasks or self-report of cognitive difficulties were found. Illness beliefs were not found to play a role in moderating the diagnosis threat effect, though the majority of the study sample did not report negative mTBI beliefs and expectations. Suggestibility was found to have a significant impact on WAIS-III Digit Span performance.

Conclusions: Diagnosis threat did not overtly impact on cognitive difficulties after mTBI in athletes'. However, an interaction was found between suggestibility and one neuropsychological task. Further research into this potentially novel finding, along with

further investigation into injury beliefs and whether these differ in an athlete population compared to the general population.

2. INTRODUCTION

2.1 Mild traumatic brain injury

The majority of head injuries reported in the UK are mild; around 1 million people present at hospital following a head injury and of these, 90% are mTBIs (Kay & Teasdale, 2001). The actual prevalence is most probably higher, given many people who sustain such an injury do not seek treatment (Cassidy et al, 2004). Risk of mTBI is greater in men, teenagers / young adults (Cassidy et al, 2004) and athletes (Gravel et al, 2013; Langlois, Rutland-Brown & Wald, 2006), with incidence in the latter population probably higher than studies suggest. Until recently sports concussion criteria relied heavily on loss of consciousness (LOC) (Laker, 2011; Langlois, Rutland-Brown & Wald, 2006) and athletes often do not recognise concussion (Robbins et al, 2014) or choose not to report it (Delaney et al, 2015; McCrea et al, 2004).

In the immediate aftermath of an mTBI, it is common for people to report a cluster of cognitive (e.g. attention / concentration difficulties), somatic (e.g. headaches, dizziness) and psychological (e.g. depression, anxiety) symptoms (Al Sayegh, Sandford & Carson, 2010).

Around 90% of patients who sustain an mTBI experience post-concussion symptoms the week following the accident (Carroll et al, 2004; King 1996; Lowdon, Briggs & Cockin, 1989).

However symptoms tend to have resolved by three months post-injury (Carroll et al, 2004).

2.2 Post-concussion syndrome

Although the majority of mTBI cases have no ongoing complications (Iverson, 2005; Vanderploeg, Curtiss & Belanger, 2005; Carroll et al, 2004; Cassidy et al, 2004), there are a number of people who experience persistent symptoms beyond the expected time frame, with

estimates ranging from 5% (Iverson, 2005) to 53% (Dikmen et al, 2010). When symptoms persist they can have a long term negative impact on quality of life, social and work functioning (Åhman et al, 2013; King & Kirwilliam, 2011; Emanuelson et al, 2003; Kendall, 1996).

When the cluster of mTBI symptoms is persistent and disruptive to day-to-day functioning, it is often referred to as post-concussion syndrome (PCS) (Ryan & Warden, 2003). There is no universally agreed definition of PCS; it is classified as postconcussional disorder in the International Classification of Diseases (ICD-10: World Health Organisation [WHO], 1992), while in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V: American Psychiatric Association [APA], 2013) it is subsumed under 'Minor Neurocognitive Disorder following TBI'. Diagnosis is often difficult given the subjectivity of symptoms (Hall, Hall, & Chapman, 2005) and their significant overlap with mental health disorders such as depression (Iverson, 2006; Iverson & Lange, 2003), physical disorders such as chronic pain (Smith-Seemiller et al, 2003) and symptom reports in healthy controls (Dean, O'Neill & Sterr, 2012).

Research into persistent symptoms has often focussed on cognitive difficulties, both objective and subjective, as these may be one of the few symptoms that differentiates PCS from overlapping disorders (Potter & Brown, 2012). There has been a number of meta-analyses investigating the long-term neuropsychological impact of mTBI (Binder et al, 1997; Belanger et al, 2005; Pertab et al, 2009; Belanger, Spiegel, & Vanderploeg, 2010; Rohling et al, 2012) and although there is evidence of a 'miserable minority' whose cognitive symptoms following mTBI persist (Ruff, Camenzuli, & Mueller, 1996), there remains contention as to whether ongoing difficulties can be attributed to neurological deficits from mTBI (Bigler et al, 2013; Larrabee et al, 2013; Pertab et al, 2009; Rohling et al, 2012). Research into the area paints a more complex picture, with premorbid (Chong, 2008; Ponsford et al, 2000) and psychological factors (Clark,

Genat & Anderson, 2012; Meares et al, 2006) being found to have predictive value in the development of PCS.

2.3 A biopsychosocial model of PCS

The current prevailing view of persistent cognitive difficulties following mTBI is typically framed in terms of biopsychosocial / diathesis-stressor models (Silverberg & Iveson, 2011; Wood, 2004; Lishman, 1988), where symptoms are triggered by specific stressors in individuals with a predisposed vulnerability. A study by Waljas et al (2015) concluded that the etiology of PCS is most likely diverse, multifactorial, and characterised by considerable individual variability, making a perspective that integrates biological, social, cognitive, affective, and behavioural factors necessary to make sense of differences in recovery among individuals.

Although there is some evidence for the contribution of neuropathological damage to ongoing cognitive difficulties (King, 2003), findings have been mixed and tend to correlate poorly with clinical outcomes (Ryb et al, 2014; Belanger et al, 2007; Hofman et al, 2002). As a result, more recent conceptualisations of PCS view biological / organic factors as being involved in the initial aetiology of mTBI, with their role lessening over time and other factors having greater responsibility for the maintenance of PCS (Ponsford et al, 2012; Meares et al, 2011; King, 2003).

2.3.1 Social and contextual factors in the development and maintenance of PCS

Compared to other aspects of the biopsychosocial model, the impact of situational and contextual factors has received comparatively less attention. This is surprising, given the interaction between contextual factors – such as media messages or healthcare settings – and psychological factors such as misattribution and expectancy effects (Vanderploeg, Belanger &

Koffman, 2014). For example, there is evidence that population-based screening for possible deployment-related mTBI in veterans resulted in increased symptom reports over time, as it is thought to 'set the stage' for negative expectancies to exert an adverse influence on the patient's belief system (Vanderploeg & Belanger, 2013; Polusny et al, 2011). Similar iatrogenic effects may be experienced in healthcare settings by people with persistent PCS symptoms, for example referral to specialists leading to beliefs about severity (Vanderploeg, Belanger & Kaufmann, 2014; Kelly, 1975).

2.3.2 *Stereotype threat*

A key situational phenomenon that may play a role in persistent PCS symptoms is stereotype threat. Stereotype threat occurs via cues in the environment that activate negative stereotypes about one's social identity and lower expectations for individual performance, which in turn negatively impact behaviour (Steele, 1997). Neither a history of stigmatisation nor internalised feelings of inferiority are necessary for individuals to succumb to stereotype threat; it can arise as a result of situational pressures alone (Aronson et al, 1999). Stereotype threat has been found to have a detrimental influence on a wide range of behaviours in varying populations, including cognitive testing in African-American students (Steele & Aronson, 1995) and those from a low socioeconomic background (Croizet & Claire, 1998); mathematical skills in women (Spencer, Steele, & Quinn, 1999); and memory in older adults (Levy, 1996).

Despite the large body of work demonstrating the stereotype threat effect, there remains uncertainty around the underlying mechanisms involved. A range of mediators have been proposed, including anxiety (Steele & Aronson, 1995), reduced motivation and effort (Hess et al, 2003; Stone, 2002), lowered performance expectations (Stangor, Carr & Kiang, 1998) and reduced working memory capacity (Schmader, Johns & Forbes, 2008; Beilock, Rydell &

McConnell, 2007). However, investigations have failed to support an unequivocal explanation as to the factors at play (Kit, Tuokko & Mateer, 2008). Kit, Tuokko & Mateer (2008) suggest the lack of clarity around contributing mechanisms reflects the complexity of the stereotype threat effect, with multiple factors having variable contributions across different settings and groups.

2.3.3 Stereotype threat in mTBI: Diagnosis threat

In recent years, research has extended to investigate stereotype threat in the mTBI population. Diagnosis threat – as it has been coined when in reference to neurological populations – uses the stereotype threat framework, suggesting awareness of negative stereotypes around mTBI can lead to performance decrements in cognitive tasks.

The phenomena was initially investigated by Suhr & Gunstad (2002), who found undergraduates that had their attention drawn to a prior mTBI performed worse on tasks tapping into general intellect and memory. A follow-up study (Suhr & Gunstad, 2005) found similar effects on tests of memory, attention and information processing speed.

More recent research has been mixed, with studies failing to replicate the size or range of cognitive decrements reported by Suhr & Gunstad (Blaine et al, 2013; Ozen & Fernandes, 2010; Kinkela, 2008). The most consistent finding in the diagnosis threat literature has been an impact on tasks of attention / working memory (Suhr & Gunstad 2005; Pavawalla et al, 2013; Kit et al, 2014; Ozen & Fernandes, 2010; Blaine et al, 2013) and processing speed (Suhr & Gunstad, 2005; Hagler & Yu, 2014; Kinkela, 2008), a similar pattern to what has been found in the stereotype threat literature as a whole (Thames et al, 2013; Barnes et al, 2012).

Ozen & Fernandes (2011) also looked at participants' self-report of day-to-day memory and attention difficulties and found these to be significantly higher in those exposed to diagnosis threat. They suggested subjective reports of everyday functioning may be more susceptible to

diagnosis threat than standard neuropsychological tests. However, as with Suhr & Gunstad's original findings, other studies investigating subjective cognitive difficulties have provided mixed results (Trontel et al, 2013, Blaine et al, 2013).

2.3.4 Individual differences in susceptibility to diagnosis threat

There is emerging evidence that interactions between social and psychological factors may best explain the differences in study results regarding diagnosis threat. Pavawalla et al (2013) found group identification mediated whether men with a history of mTBI succumbed to diagnosis threat, while other studies have posited the psychological construct of self-efficacy as a mediator between diagnosis threat and cognitive performance (Kit et al, 2014; Trontel et al, 2013). In other clinical populations self-efficacy – the perceived ability to successfully manage the demands of a specific situation (Bandura, 1997) – has been found to be affected by individual's illness beliefs (Griva et al, 2000; Lau-Walker, 2007), which may underlie findings in the diagnosis threat literature.

Health psychology research has found that patients construct beliefs around the identity, consequences, timeline, controllability and causal attributions of their condition in order to make sense and cope with it (Leventhal, Leventhal, & Contrada, 1998; Leventhal, Meyer, Nerenz, 1980). These illness / injury perceptions guide behaviour and have been found to have a large influence on medical and psychological health outcomes for a range of diseases and disorders (Llewellyn, McGurk & Weinman, 2007; Helder et al, 2002; Kaptein et al, 2006; Petrie, Moss-Morris & Weinman, 1995; van Ittersum et al, 2009). Within mTBI, greater endorsement of negative beliefs around the identity, consequences, timeline, controllability and causal attributions of the injury have been found to be related to greater symptom report (Var & Rajeswaran, 2012) and can be predictive of PCS (Snell et al., 2015; Snell et al, 2013; Hou et al,

2012; Snell et al, 2011; Whittaker et al, 2007). However, illness beliefs have not previously been investigated as potential mediators of the diagnosis threat effect.

There is evidence that individuals anticipate certain symptoms following mTBI, even if they have not experienced one (Sullivan & Edmed, 2012; Mulhern & McMillan, 2006). Such expectations can lead individuals to attribute symptoms to their mTBI as opposed to other potential etiologies (i.e. normal cognitive lapses) (Mittenberg et al, 1992; Ferguson et al, 1999).

There is also evidence that people with a history of mTBI display a 'good old days' bias, underestimating pre-injury difficulties (Yang et al, 2014; Gunstad & Suhr, 2001; Ferguson et al, 1999; Gunstad & Suhr, 2004; Iverson et al, 2010; Lange, Iverson & Rose, 2010). Both kinds of misattribution can affect individual's perceived level of current symptoms, difficulties and recovery; Belanger et al (2013) found the extent to which people attribute symptoms to mTBI versus other causes was one of the main factors that predicted PCS.

However, although there is evidence that people hold negative expectations around outcome for even relatively mild TBIs (Sullivan & Edmed, 2012; Mulhern & McMillan, 2006), it is also clear that this is not pervasive in the general population, and may be primed by the experimental context (Mulhern & McMillan, 2006; Macenzie & McMillan, 2005). Expectations may also vary according to the group of individuals being studied. For example, athletes often do not perceive concussion as a serious injury and expect few long-term consequences (Delaney et al, 2015; McCrea et al, 2004). Previous research has not investigated injury belief biases and variation in relation to the impact of diagnosis threat.

The placebo effect (Bootzin & Bailey, 2005) of beliefs and expectations described above is thought to be moderated by individual differences in suggestibility and responsivity to external influences (Delis & Wetter, 2007; Spiegel, 2007). Suggestibility refers to the tendency to accept and act on the suggestions of others. Research has found suggestibility to be linked with negative ideas about one's own memory (van Bergen, Jellic & Merckelback, 2009), and

has been implicated in subjective reports of cognitive difficulties in syndromes that overlap with PCS symptoms, such as chronic fatigue (DiClementi et al, 2001). The construct of suggestibility seems well placed as a source of potential individual difference that might explain the heterogeneity of diagnosis threat study results. However, the variable has not received investigation in mTBI literature, despite being highlighted as a possible avenues for future research (Kit et al, 2013).

Therefore in order to understand diagnosis threat effects, including the inconsistencies between previous studies, research is needed into how this effect interacts with individual psychological variables such as injury beliefs and suggestibility. This research also has the potential to help inform clinical formulation about the difficulties experienced by someone with PCS from a biopsychosocial perspective. Given psychosocial factors may be amenable to change (Trontel et al, 2013; Mikulincer, 2001), findings may also have important implications for testing environment and treatment.

2.4 The current study

The current study investigated diagnosis threat effect on neuropsychological tests and subjective reporting of cognitive difficulties in a specific population at risk for mTBI population: amateur athletes engaged in contact sports (boxing and rugby). This contrasts with the majority of previous studies which have been conducted in undergraduate university samples.

To our knowledge, no study has yet investigated pre-existing injury beliefs as a possible mediating factor, despite this being a core factor in the stereotype threat experimental paradigm. Given the query as to how pervasive negative expectations of mTBI are, the current research investigated the interaction between illness beliefs and diagnosis threat. It was hypothesised that individuals holding beliefs that their symptoms have serious negative

consequences and are subject to diagnosis threat will perform worse on neuropsychological measures and report a greater degree of subjective cognitive problems.

This study also looked at whether suggestibility is a possible moderator of diagnosis threat, hypothesising that those displaying greater suggestibility would perform worse if exposed to diagnosis threat.

3. METHOD

3.1 Design

The current study is a mixed experimental and observational design. The experimental component of the study investigated the between-subject variable of group; diagnosis threat (instructions mention participant's mTBI history) or neutral (instructions make no mention of mTBI). Group allocation was considered the independent variable, with neuropsychological measures (i.e. Wechsler Adult Intelligence Scale subscales) and subjective measures (i.e. self-report of everyday memory and attention failures) were considered dependent variables. An experimental design was chosen in order to determine a causal relationship between the experimental manipulation (drawing attention to previous mTBI) and actual and perceived cognitive performance. The potential moderating roles of illness beliefs and suggestibility were investigated through an observational design.

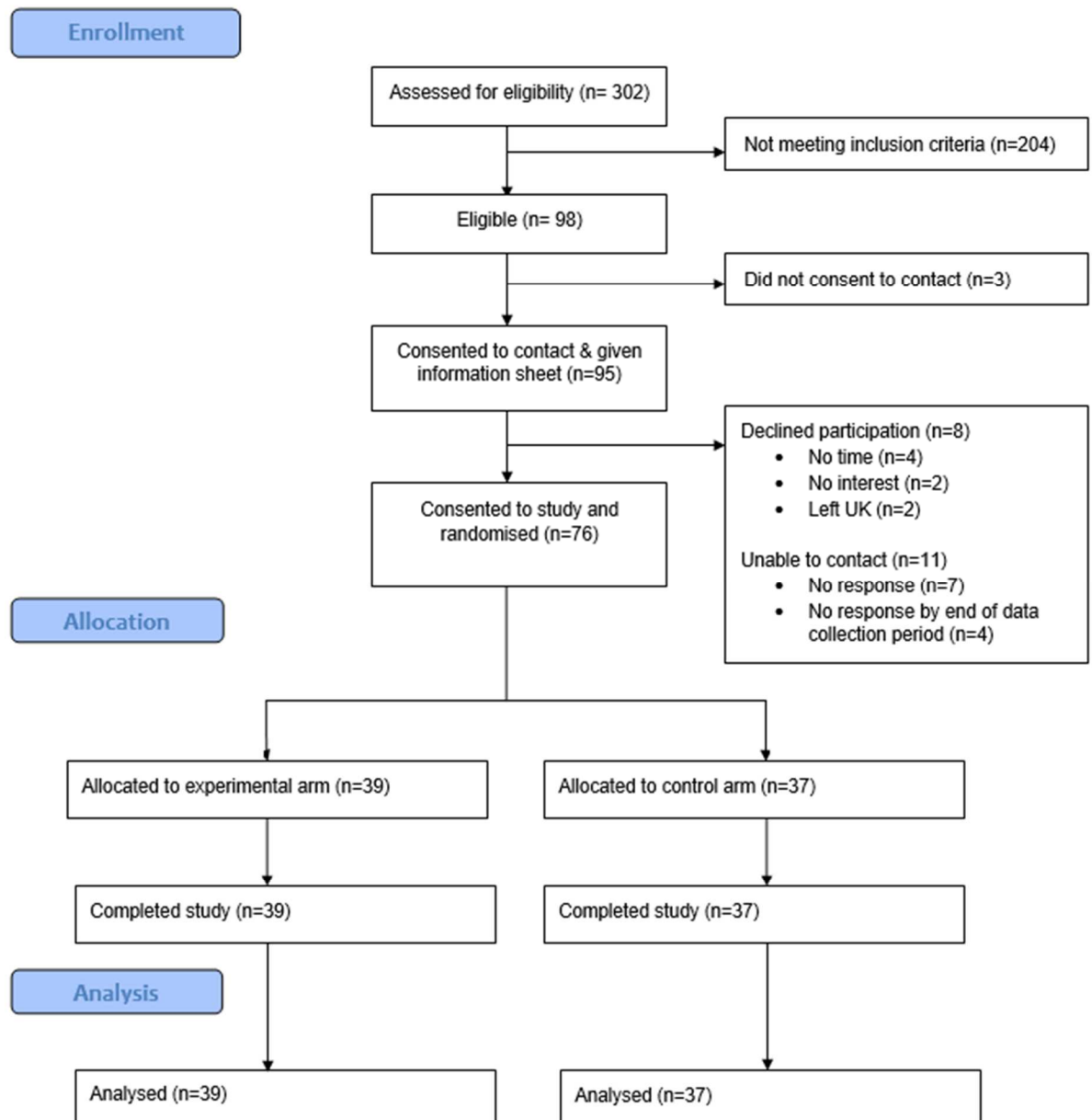


Figure 1. CONSORT flow diagram showing progression of participant through study

3.2 Participants

Participants with a history of mTBI were recruited via 16 London-based boxing clubs and 4 London-based rugby clubs. This avenue of recruitment was chosen as contact sports players have a higher incidence of mTBI compared to the general population (Gravel et al, 2013; Langlois, Rutland-Brown & Wald, 2006).

Clubs were identified with the support of the Amateur Boxing Association of England (ABAE), King's College London Sports Union (KCLSU) and via word of mouth. Owners and coaches at clubs were approached via email or telephone and asked if they would be happy for club members to be invited to take part in the current research. If interest was expressed, a face-to-face meeting was organised to explain the study in more detail and to obtain signed consent to approach club members (see *Appendix 1*). It was made clear that providing the researcher the opportunity to discuss the current research with club attendees did not make them obliged to participate.

In line with existing studies, the American Congress of Rehabilitation Medicine's (Kay et al, 1993) definition of mTBI was used to identify individuals with a history of mTBI. Therefore, inclusion criteria required participants to present with "a traumatically induced physiological disruption of brain function, as manifested by at least one of the following:

- Any period of loss of consciousness (LOC)
- Any loss of memory for events immediately before or after the accident (PTA)
- Any alteration in mental state at the time of the accident (e.g., feeling dazed, disoriented, or confused)
- Focal neurological deficit(s) that may or may not be transient; but where the severity of the injury does not exceed the following:
 - LOC of ≤ 30 minutes
 - After 30 minutes an initial Glasgow Coma Scale of 13-15 and
 - PTA ≤ 24 hours

This definition includes the head being struck, the head striking an object and the brain undergoing an acceleration / deceleration movement (i.e. whiplash) without direct external trauma to the head.”

Individuals were excluded from the study if they had sustained a moderate-severe TBI, defined in this study as any TBI where LOC was greater than 30 minutes or PTA exceeded 24 hours. Individuals were also excluded if they were currently receiving treatment for their mTBI or were in litigation regarding circumstances surrounding their mTBI. If individuals had sustained their mTBI within the past 3 months (i.e. within the time period where cognitive symptoms would be deemed to be within normal recovery expectations), they were not contacted for the second part of the study until a 3 month period since injury had elapsed. When contacted, it was checked that they had not received any further injuries since screening.

To provide a wider, heterogenous sample of the group being studied, no restrictions were made on whether individuals had a current mental health diagnosis nor whether they had any neurological conditions. There were also no restrictions on recruitment by gender, although given the specific population (boxers and rugby players) it was anticipated that the majority of participants would be male. Similarly, anyone over 18 was eligible to take part in the study, but it was expected that the majority of participants would fall between the range of 18-40, in line with the age range usually found in boxing and rugby clubs.

3.3 Participant flow

Participant flow can be seen in *Figure 1*. Overall, 302 individuals were screened, and 98 people (32%) met criteria for having sustained an mTBI in the past. Of these, 95 individuals (97%) signed consent to contact sheets (See *Appendix 2*) and were provided with information sheets about the study (see *Appendix 3*). Of the individuals that provided initial consent to contact, 76 (80%) agreed to attend a testing session when contacted. All of these

subsequently provided written informed consent and completed the study. The remaining 19 individuals either could not be contacted (n=7); withdrew consent to contact owing to lack of time (n= 4), lack of interest (n= 2), or having moved out of the UK (n=2); or had not responded by the end of the data collection period (n= 4). A breakdown of responses by sports club can be found in *Appendix 4*.

No participants had to be excluded retrospectively and none chose to withdraw their consent post-testing. Demographic differences (e.g. age, gender) between individuals who provided consent and those that did not could not be analysed as this information was collected after written informed consent was obtained and was therefore unavailable for individuals who chose not to participate.

Differences between sports were noted with regard to participant flow. Within boxing clubs, 25% of people completing the general health screen met eligibility, compared to 56% of rugby players – a significant difference ($\chi^2 (1, n=302) = 24.54; p < .001$). No difference was found between sports with regard to eligible participants providing consent to contact ($\chi^2 (1, n=99) = .474; p = .491$), although consenting participants completing the study ($\chi^2 (1, n=80) = 4.93; p = .026$) varied significantly between boxing and rugby clubs.

3.4 Procedure

The protocol was approved by King's College London (KCL) College Research Ethics

Committees' Psychiatry, Nursing & Midwifery Research Ethics Subcommittee (CREC) (See

Appendix 5.)

Stage	Information collected
Approach club	<ul style="list-style-type: none"> • Consent to approach club members
Screening	<ul style="list-style-type: none"> • General health & injury screen • Brief Illness Perception Questionnaire • Consent to contact
Testing	<ul style="list-style-type: none"> • Demographic information • Written informed consent • Wechsler Test of Adult Reading • Neuropsychological tasks (WAIS-III subtests) • Subjective cognitive functioning questionnaires (ARCES; MFS) • Mood questionnaires (BDI; STAI-T) • Gudjonsson Compliance Scale

Table 1. Stages of recruitment

WAIS-III= Wechsler Adult Intelligence Scale – 3rd Edition; ARCES= Attention-Related Cognitive Errors

Scale; MFS=Memory Failures Scale; BDI=Beck Depression Inventory; STAI-T=State Trait Anxiety Inventory

– trait subscale

Potential participants were approached at the start or end of training sessions at sports clubs and verbally informed that the current research was being conducted. At this point mTBI was not explicitly mentioned, in order to mask the hypothesis from potential participants.

Individuals were informed that the study was looking at thinking skills and personality and provided a description of what the study would involve. It was explained that not everybody would be needed for the main part of the study, but that those completing it would receive a small remuneration (£10) for their participation.

Individuals reporting interest in partaking in the research were asked to complete a brief screening evaluation (approximately 3-5 minutes long) in order to determine eligibility. The screening evaluation included a head injury questionnaire that explicitly asked about LOC, PTA and feeling dazed, confused and disorientated, to gain a clear idea of injury severity. It also contained questions relating to exclusion criteria (e.g. “are you currently undergoing any litigation or medicolegal compensation claims?”). Questions probing head injury status and exclusion criteria were couched within questions about general health and injury history and presented to participants as a confidential general health screen (GHS), in order to mask the hypothesis (see *Appendix 6*).

Participants reporting a history of mTBI were asked to complete a brief illness perceptions questionnaire (B-IPQ) at the screening stage. Participants reporting other injuries (e.g. neck / back; other), were also asked about beliefs regarding these injuries using the B-IPQ, in order to mask the fact that the study was specifically looking at mTBI. If participants had reported a history of more than one mTBI they were asked to complete the B-IPQ with regard to the most severe mTBI they had sustained. The B-IPQ was administered at the screening stage for a number of reasons. It was felt that the B-IPQ may trigger individual beliefs about mTBI and that by leaving a period of time between the questionnaire and neuropsychological tasks, this possible confound could be avoided. Conversely, it was felt that responses on the B-IPQ may have been impacted by perceived performance if the questionnaire had been administered immediately after testing. Finally, administering the questionnaire at the screening stage allowed it to be presented in a more general injury screen, thus obscuring the true nature of the study from potential participants.

All participants completing the GHS were asked to sign a consent to contact sheet and provided with an information sheet about the study and contact details of the researcher should they have queries. Eligible individuals were contacted a minimum of 48 hours after screening, in order to provide time for them to have read the information sheet and decide whether they would like to take part in the study. Information provided by non-eligible participants was shredded.

Permuted block randomisation by strata (type of sports club) was used to assign participants to experimental or control conditions. This ensured that each arm had an equal sample size and was formed of an equal number of participants from each type of sports club, avoiding potential differences between rugby players and boxers confounding any significant findings. For each sports type (boxing and rugby), the researcher received a block of 4, 6 or 8 sealed envelopes containing an equal number of diagnosis threat and neutral task instructions in random order. Block size was randomly varied to avoid predictability. The randomisation procedure was done by an individual outside of the research team, in order to keep the researcher blind as to which block size was being used.

Eligible individuals were invited to take part in the study at KCL university buildings or, where available, in a quiet room at the sports club they were affiliated with. On attending the study, the information sheet was provided again and opportunity to ask questions was given. After this written informed consent and demographic information (e.g. age, profession) was obtained and each participant was given an envelope with instructions inside. Instructions were adapted from those used by Suhr & Gunstad (2002). Those randomly assigned to the diagnosis threat group read the following instructions:

You have been invited to participate in this study because of your response to one of the questionnaires included in the initial general health screening. Your response indicated a history of head injury / concussion. A growing number of neuropsychological / thinking skills studies find that many individuals with head injuries / concussions show cognitive deficits on neuropsychological / thinking skills tests. Deficits in areas such as attention, memory and speed of information processing are common, though other deficits sometimes emerge. This study examines the role that head injury may play in these cognitive areas to better understand the nature of the disorder.

The experimenter will now ask you to complete a brief collection of common thinking skills / neuropsychological tests. These tests will assess skills such as attention, memory, speed of information processing, etc. Some of the tests are easy, some are more difficult. Please give your best effort. You will then be asked to complete some questionnaires asking about your thinking skills, personality and mood. Questions about individual tasks will be answered following the testing.

Those randomly assigned to the neutral group read the following instructions:

The experimenter will now ask you to complete a brief collection of common thinking skills / neuropsychological tests. These tests will assess skills such as attention, memory, speed of information processing, etc. Some of the tests are easy, some are more difficult. Please give your best effort. You will then be asked to complete some questionnaires asking about your thinking skills, personality and mood. Questions about individual tasks will be answered following the testing.

Participants were asked to read the contents and then return the instructions to the envelope without notifying the researcher what had been read. This procedure ensured that the researcher remained unaware of group allocation until the end of the testing period.

After reading the instructions, participants completed a brief neuropsychological battery containing the Wechsler Test of Adult Reading and WAIS-III Digit-Span, Arithmetic, Letter-Number Sequencing and Digit-symbol Coding subtests in that order. Once cognitive tasks were complete, participants completed questionnaire measures in the following order: Attention-related Cognitive Error Scale (ARCES); Memory Failures Scale (MFS); Beck Depression Inventory (BDI); State-Trait Anxiety Inventory (STAI-T); Eysenck Personality Questionnaire (EPQ-N); and Gudjonsson Compliance Scale (GuCS).

At the end of the study participants were debriefed. It was explained that they had been selected on the basis of having sustained mTBI at any time in the past and the main hypotheses of the study was revealed. It was clarified that any information given within test instructions regarding the effect of head injury on thinking ability is rarely found with individuals' suffering from an mTBI and that many individuals with a history of head injury don't experience thinking difficulties at all. Participants were provided with a debriefing sheet (see *Appendix 7*) and provided the opportunity to ask questions. The debriefing sheet included a request to not discuss the study with other people who could potentially be recruited until after data collection ended, in order to keep the study hypothesis from potential participants.

Participants were remunerated £10 at the end of the study. Feedback about individual performance was not routinely offered. However, the researcher answered general questions regarding performance and provided feedback on individual performance if it was specifically requested (n=8).

3.5 Measures

3.5.1 Injury-related and demographic information

Individuals who met criteria for inclusion were asked to provide injury-related, clinical and demographic information. Injury-related and clinical information was collected at screening via the GHS. Demographic data was gleaned during the study testing session, after written informed consent had been taken. The following data was collected:

- Injury-related information: date and cause of injury, length of LOC or alteration of consciousness, length of PTA, details of any treatment received at the time of injury

- Clinical information: ongoing medical investigations or treatments, specialist appointments, involvement in litigation or medicolegal claims, level of alcohol intake (units / week), current medication
- Demographic information: date of birth, current occupation

3.5.2 Neuropsychometric measures

The following neuropsychometric measures were administered to both participant groups:

Wechsler Test of Adult Reading (WTAR: Holdnack, 2001): A neuropsychological test developed for use in English speakers aged 16-89, originally designed to estimate premorbid intelligence following illness or injury. The test makes use of the correlation between vocabulary level and intelligence, requiring participants to articulate irregularly spelled words that are hard to pronounce without prior knowledge. The WTAR is co-normed with the WAIS-III, allowing for comparative analyses on predicted and actual general intelligence. WTAR scores have been shown to correlate with verbal and general intelligence (Spreen, Sherman & Strauss, 2006) and the test shows good stability over time in brain injury patients (Green et al, 2008).

Wechsler Adult Intelligence Scale - 3rd Edition (WAIS-III: Wechsler, 1997): A neuropsychological battery comprising 10 core subtests and 5 supplementary subtests, designed to measure adult intelligence. In addition to providing a Full Scale Intelligence Quotient, it also provides information on four cognitive indices: Verbal Comprehension, Working Memory, Perceptual Organisation, and Processing Speed. The measure shows good reliability and validity (Wechsler, 1997).

The current study was interested in performance on attention / working memory and processing speed tasks, as these cognitive domains have been found to be most sensitive to diagnosis threat in previous research. Therefore, the two core tests (Digit Span, Arithmetic)

and one supplementary test (Letter-Number Sequencing) of the Working Memory index was used, along with one of the core tests from the Processing Speed index (Digit-Symbol Coding).

3.5.3 *Psychological measures*

A range of psychological measures were administered to both participant groups. The B-IPQ was administered at the screening evaluation, while the rest of the psychological measures being completed during the testing session. The EPQ was not administered for data synthesis, but rather as a distractor item to reduce the chance of participants guessing the experimental hypotheses, in line with the presented focus of the study to look at personality and cognitive performance. The battery of psychological measures used for both experimental and control groups are detailed below and can be found in *Appendix 8*:

Brief Illness Perception Questionnaire (B-IPQ: Broadbent et al, 2006): A self-report measure of illness representations adapted from the Illness Perception Questionnaire - Revised (IPQ-R; Moss-Morris et al, 2002). It has been found to show good test-retest reliability, concurrent validity and predictive validity (Broadbent et al, 2006). The B-IPQ is composed of eight items rated using a 0-10 Likert scale. A ninth open-ended response item was omitted for the purpose of the current study. Five items probe different dimensions of Leventhal et al's (1984) cognitive model of illness perceptions; consequences, timeline, personal control, treatment control and identity. Two items assess emotional representations and one item illness comprehensibility. Items have been found to have satisfactory internal reliability (Hou et al, 2012) and therefore total B-IPQ score was used in the current study.

Attention-related Cognitive Error Scale and Memory Failures Scale (ARCES & MFS, Carriere, Cheyne & Smilek, 2006): The ARCES measures the frequency with which one experiences a

variety of everyday cognitive failures for which attention lapse is the most likely cause. It was developed based on items from the Cognitive Failures Scale (Broadbent et al, 1982), Reason's diary studies (Reason & Mycielska, 1982) and diaries of the authors' own experiences. The MFS is a measure of everyday memory failures that are minimally explained by attentional errors. Both scales are self-report, containing twelve questions rated on a 5-point Likert scale ranging from 'Never' to 'Very Often'. Higher scores reflect more frequent attention / memory lapses. Both the ARCES and MFS have been shown to have good psychometric properties, including no significant deviations from normality, good internal consistency, and good correlation between items (Carriere, Cheyne & Smilek, 2008).

Beck Depression Inventory – Second edition (BDI-II; Beck, Steer, & Brown, 1996): a self-report measure of depressive symptoms as described by the DSM-IV (American Psychiatric Association, 1994). The scale comprises 21 items where participants read a list of statements relating to depression and select the one most in line with how they have felt over the past two weeks. Scores range from 0-63, with scores above 14, 20 and 29 indicating mild, moderate or severe depression respectively. The inventory has been shown to have good internal consistency and validity, and validity in differentiating between depressed and non-depressed subjects (Richter et al, 1998).

State-Trait Anxiety Inventory – Trait-anxiety scale (STAI-T; Spielberger et al, 1983): A measure of trait anxiety, or general level of anxiety. It is made up of 20 questions participants self-rate on a 4-point Likert scale, ranging from 'Almost Never' to 'Almost Always'. Scores range from 20 to 80, with higher scores correlating with greater anxiety. Scores over 45 suggest anxiety (Spielberger et al, 1983). The questionnaire has been shown to have adequate construct validity and test re-test validity (Tilton, 2008).

Gudjonsson Compliance Scale (GuCS: Gudjonsson, 1989): a self-report questionnaire which was used as a measure of suggestibility, given its high correlation with the Gudjonsson Suggestibility Scale (GSS: Gudjonsson, 2003). The GuCS consists of 20 statements answered as either ‘true’ or ‘false’, with higher scores indicating greater compliance / suggestibility. The scale has been shown to have satisfactory internal consistency and test-retest reliability (Gudjonsson, 1989).

Revised Eysenck Personality Questionnaire – Short form ([EPQR-S]: Eysenck, Eysenck & Barrett, 1985): A measure of personality based on Eysenck’s (1976) three factor model of personality, with good reliability reported (Eysenck et al, 1985). The 12-item neuroticism subscale was used as a distractor task for the current study, to hide the hypothesis from participants.

4. RESULTS

4.1 Preliminary analysis

4.1.1 Homogeneity

All data met assumptions of normality, with the exception of the BDI (which displayed floor effects) and the WTAR-predicted FSIQ (which showed negative skew). The latter was transformed by squaring the data, which corrected the non-normal distribution, and the updated dataset was used for the statistical analysis.

Participants

Variable	Diagnosis Threat (N=39)	Control (N=37)

Age (years; <i>M</i> , <i>SD</i>)	28 (7.43)	27.89 (6.87)
Sex (Male; %)	82	86
WTAR Predicted FSIQ (<i>M</i> , <i>SD</i>)	105.82 (8.90)	104.59 (8.83)
Occupation (Student; %)	23	35
1 st language (English; %)	92	89
Sport (Boxers; %)	64	65
Testing location (University; %)	67	68
Sports related injury (%)	85	86
Treatment sought (%)	15	24
TSI (months; <i>M</i> , <i>SD</i>)	67.64 (81.97)	43.81 (50.66)
LOC (minutes; <i>M</i> , <i>SD</i>)	1.06 (2.18)	2.48 (6.64)
PTA (minutes; <i>M</i> , <i>SD</i>)	3.96 (7.52)	1.74 (3.27)
B-IPQ (<i>M</i> , <i>SD</i>)	17.28 (11.75)	15.38 (12.19)
Mental health diagnosis (%)	5	5
Neurological disorder (%)	5	5
Depression (BDI; <i>M</i> , <i>SD</i> , % above cutoff*)	4.67 (5.28), 8	4.73 (3.46), 5
Anxiety (STAI-T; <i>M</i> , <i>SD</i> , % above cutoff*)	36.21 (10.97), 18	35.41 (9.0), 19
Weekly alcohol consumption (units, <i>M</i> , <i>SD</i>)	10.13 (10.50)	10.32 (10.66)
Suggestibility (GuCS; <i>M</i> , <i>SD</i>)	7.56 (3.53)	6.57 (3.69)

Table 2. Demographic, clinical and injury-related characteristics of study participants

WTAR= Wechsler Test of Adult Reading; FSIQ=Full Scale Intelligence Quotient; TSI=Time Since Injury;

LOC=Loss of Consciousness; PTA=Post Traumatic Amnesia; B-IPQ=Brief Illness Perceptions

Questionnaire; BDI=Beck Depression Inventory; STAI-T=State Trait Anxiety Inventory – trait subscale;

GuCS= Gudjonsson Compliance Scale

* BDI cut-off for depression >14; STAI-T cut-off for anxiety >45

The data were analysed using SPSS version 22. The data were screened for entry errors (i.e. missing values), with no missing data recorded. An alpha level of $p < 0.05$ was applied to determine statistical significance.

4.1.2 Group differences at baseline

Preliminary analyses were undertaken to determine whether study randomisation had resulted in similar groups on demographic and other baseline characteristics.

4.1.2.1 Demographic differences

There were no significant differences between experimental and control participants in terms of gender ($\chi^2 (1, n=76) = .281$; $p = .60$), age ($t(74) = .066$; $p = .95$), WTAR-predicted FSIQ ($t(74) = .601$; $p = .550$), occupation ($\chi^2 (2, n=76) = 4.68$; $p = .096$) or English proficiency ($\chi^2 (1, n=76) = .221$; $p = .638$). There was not found to be a difference between arms regarding where participants were tested ($\chi^2 (1, n=76) = .007$; $p = .93$), nor whether they were recruited from boxing or rugby clubs ($\chi^2 (1, n=76) = .005$; $p = .945$). Suggestibility was also not significantly different between groups ($t(74) = 1.203$; $p = .096$).

4.1.2.2 Clinical & injury-related differences

No differences regarding injury details were noted, including whether the injury mechanism was sports-related or not ($\chi^2 (1, n=76) = 3.283; p=.656$); whether treatment was sought ($\chi^2 (1, n=76) = .958; p=.328$); time since injury ($t(74) = 1.515; p=.134$); or whether LOC ($\chi^2 (1, n=76) = .436; p=.509$) or PTA ($\chi^2 (1, n=76) = .164; p=.686$) occurred. Beliefs around head injury, as measured by the B-IPQ ($t(74) = .694; p=.490$) did not differ between groups.

Arms did not vary significantly on whether participants reported a mental health diagnosis ($\chi^2 (1, n=76) = .003; p=.957$) or neurodevelopmental disorder ($\chi^2 (1, n=76) = .003; p=.957$), nor on reported alcohol intake ($t(74) = -.081; p=.936$).

4.1.2.3 Group differences by sport

Although no differences were found between arms, additional analysis found significant differences between those recruited from boxing and rugby clubs. Boxers were older ($t(74) = 3.405; p=.001$) and were more likely to report PTA ($\chi^2 (1, n=76) = 3.299; p=.001$). A significant difference between alcohol consumption between the two sports was also found ($t(74) = -5.633; p<.001$), with rugby players reporting higher levels. In addition, there were significantly more student rugby players ($\chi^2 (2, n=76) = 18.528; p<.01$), owing to recruitment through KCLSU teams. However, the randomisation procedure employed meant that these differences did not result in differences between study arms.

4.2 Main analysis

4.2.1 *Diagnosis threat and neuropsychological test performance*

The primary hypothesis being tested was that participants in the diagnosis threat arm would show impaired neuropsychological test performance compared to those in the control arm. As

the data did not violate assumptions of normality, independent sample T-tests were used to compare groups on performance on neuropsychological tests.

No significant effects were found for performance on any of the neuropsychological test measures (See *Table 3*).

4.2.2 *Diagnosis threat and subjective cognitive difficulties report*

A secondary hypothesis was that people subject to the diagnosis threat condition would self-report more failures of attention and memory compared to those in the neutral condition. As with the primary hypothesis, independent sample T-tests were used to compare the groups on the ARCES and MFS.

No significant effects were found for responses on the ARCES or MFS (See *Table 3*).

Variable	Diagnosis Threat	Control	Post hoc differences	
	Mean (sd)	Mean (sd)	t	p
Neuropsychological tests				
WAIS-III Digit Span	11.59 (3.18)	11.81 (2.30)	-.346	.731
WAIS-III Arithmetic	12.26 (2.79)	11.84 (2.97)	.634	.528
WAIS-III Letter-Number Sequencing	12.77 (3.91)	11.51 (3.37)	1.496	.139
WAIS-III Coding	11.92 (3.01)	10.86 (2.67)	1.618	.110
Subjective cognitive difficulties report				
ARCES	29.90 (6.88)	30.89 (8.08)	-.579	.564
MFS	26.13 (5.88)	25.54 (5.87)	.436	.664

Table 3. Performance on neuropsychological tasks and questionnaires responses

WAIS-III= Wechsler Adult Intelligence Scale – 3rd Edition; ARCES= Attention-Related Cognitive Errors Scale; MFS=Memory Failures Scale

4.3 Analysis of moderators

4.3.1 Diagnosis threat x Illness Beliefs

It was hypothesised that there would be an interaction between illness beliefs (as measured on the B-IPQ) and diagnosis threat, whereby individuals holding beliefs that their symptoms have serious negative consequences and who were subject to diagnosis threat would perform worse on neuropsychological measures and report a greater degree of subjective cognitive problems. This hypothesis was tested with a 2 x 2 ANCOVA, with group (diagnosis threat / neutral) and Belief score (range 0-80) as between participant factors.

Contrary to expectations, no Group x Belief interaction was noted for WAIS-III Digit Span ($F(1, 72) = .43, p = .836$) Arithmetic ($F(1, 72) = 1.745, p = .191$), Letter-Number Sequencing ($F(1, 72) = 1.017, p = .317$) or Coding scores ($F(1, 72) = 2.505, p = .118$). Additionally, no significant interaction was found for responses on the ARCES ($F(1, 72) = .215, p = .664$) or the MFS ($F(1, 72) = .064, p = .801$). None of the assumptions of the ANCOVA test were violated.

4.3.2 Diagnosis threat x Suggestibility

Finally, the hypothesis that individuals scoring higher on the GuCS and who were subject to diagnosis threat would perform worse on neuropsychological measures and report a greater degree of subjective cognitive problems was investigated using a 2 x 2 ANCOVA. Threat condition (diagnosis threat / neutral) and suggestibility (range 0-20) were between participant factors.

A significant Group x Suggestibility interaction emerged on the WAIS-III Digit Span, with those scoring high in suggestibility experiencing a greater performance decrement as a result of diagnosis threat instructions ($F(1, 72) = 4.547, p = .036$). Each point increase on the GuCS was associated with a .36 decrease on WAIS-III Digit Span performance ($\beta = -.36, t(76) = -2.132, p = .036, 95\% \text{ CI } (-.694 - -.023)$).

No Group x Suggestibility interaction was noted for WAIS-III Arithmetic ($F(1, 72) = .167, p = .684$), Letter-Number Sequencing ($F(1, 72) = .496, p = .483$) or Coding scores ($F(1, 72) = 2.098, p = .152$). Additionally, no significant interaction was found for responses on the ARCES ($F(1, 72) = .586, p = .446$) or the MFS ($F(1, 72) = .130, p = .719$). None of the assumptions of the ANCOVA test were violated.

5. DISCUSSION

5.1 Summary of findings

The current study used an experimental design to look at whether alerting individuals to their history of mTBI activated negative expectations (i.e. diagnosis threat) that led to a decrease in neuropsychological test performance and increase in subjective reporting of cognitive difficulties.

Contrary the study's hypotheses, results showed no difference on performance between participants in the diagnosis threat arm and those in the control arm on any of the neuropsychological tests administered, nor on self-report of day-to-day cognitive lapses.

A secondary hypothesis that injury beliefs would play a mediating role in whether individuals succumbed to diagnosis threat also failed to be supported by the data. There was some evidence to support the hypothesis that participants displaying higher suggestibility who were subject to diagnosis threat would perform worse on neuropsychological measures, with a significant interaction being found on one neuropsychological test (WAIS-III Digit Span).

5.2 Impact of diagnosis threat

In contrast to our hypotheses, the current study did not provide evidence of a diagnosis threat effect on neuropsychological measures of working memory / attention or processing speed. In fact, although non-significant, the numerical data showed a trend in the opposite direction than hypothesised, with the diagnosis threat group performing better on two measures (WAIS-III Letter-Number Sequencing & WAIS-III Coding). Similarly, no significant impact of diagnosis threat on subjective reports of cognitive function was found.

These findings may have come about because of participants not identifying with the 'mTBI' stereotype strongly enough for it to elicit a diagnosis threat response. Group identification has been found to be a moderator for both stereotype threat (Steele, Spencer & Aronson, 2002) and diagnosis threat (Pavawalla et al, 2013). However, participants typically reported that their injury took place a long time ago ($M=56$ months, $sd=69.14$) with 80% not seeking medical treatment, and the average reported injuries in the mild end of mTBI (mean LOC was 1.7 minutes ($sd=4.75$), mean PTA was 2.8 minutes ($sd=5.7$), compared with the ceiling of 30 minutes and 24 hours respectively for mTBI). Participants may not have seen the 'mTBI' stereotype as personally relevant. In addition, the academic nature of the neuropsychological tasks and testing environment may have led to the activation of more salient 'student' or 'professional' stereotypes in some, which may include positive beliefs about cognitive ability.

Another possible reason for the null findings is that a stereotype reactance effect occurred, which posits that when a negative stereotype is blatantly activated, individuals may consciously react differently in their motivation to 'prove it wrong' (Nguyen & Ryan, 2008). Stereotype reactance effects have been found for women in negotiating situations (Kray et al, 2004) and maths tasks (Pavawalla et al, 2013). Our study population was high achieving – as reflected by above average predicted FSIQ scores ($M=105.22$, $sd=8.854$) and a high percentage

reporting being in professional jobs or further education (68.4%) – which can make stereotype reactance effects particularly marked (Kray et al, 2004). Although not investigated in the current research, Kit et al (2013) found that mTBI groups endorsed a greater level of motivation to perform well on neuropsychological tests when compared with healthy controls, which supports the notion that those with a history of mTBI may consciously wish to refute negative stereotypes. Additionally, qualitative feedback from a number of participants at debriefing highlighted a desire to prove test instructions wrong as a motivating factor.

5.3 The role of illness beliefs

Illness beliefs were not found to play a significant role in whether participants succumbed to diagnosis threat, although the narrow range of responses makes it difficult to draw conclusions from the data. The majority of participant B-IPQ scores were low; although the measure ranged from 0-80, only two responses were above 40, with the mean rating being 16.36 (sd=11.92). Therefore, the study population almost exclusively reported neutral or positive beliefs / expectations around the impact of mTBI. It may be that illness beliefs only have a deleterious effect when explicitly negative.

Study population characteristics may explain the lack of negative expectations reported. As previously highlighted, few participants actively sought treatment for their mTBI, which already suggests a low level of concern regarding the impact of the injury. This is in contrast to other studies investigating mTBI injury beliefs, which have recruited participants through A&E or concussion clinics (Hou et al, 2012; Snell et al, 2011; Whittaker et al, 2007). In addition, the majority of participants (85.5%) sustained their injury in a sporting accident, which may be perceived as a less negative mechanism of injury (e.g. compared to a road traffic accident) (Blaine et al, 2013).

The study recruited from a 'high risk' population of amateur athletes who, regardless of how they obtained their own injury, may have different expectations regarding mTBI recovery compared to the general population. Athletes have been found to expect fewer symptoms than non-athletes or depressed individuals, which may be due to pre-existing expectations for speedy recovery (Gunstad & Suhr, 2001). Such expectations may come from their own concussion experience contrasting with negative stereotypes (Weber & Edwards, 2010), witnessing others' positive mTBI recovery, or general expectation or pressure from peers and coaches (Gunstad & Suhr, 2001).

The 'culture of concussion' has been an area of interest in sports research in recent years (Murray, Murray & Robson, 2015; Adler & Herring, 2011), with studies looking into reasons why athletes often do not report mTBIs sustained during play (McCrea et al 2004). Numerous beliefs have been found to have an impact, including beliefs related to perceived severity, desire to continue playing, importance of the match, ostracisation from teammates and disappointment from coaches (Delaney et al, 2015; Register-Mihalik et al, 2013; Chrisman, Quitiquit & Rivara, 2013; McCrea et al, 2004). Although researched in the context of under-reporting of mTBI during games, such beliefs around mTBI during play being something of an 'occupational hazard' may inoculate athletes from persistent PCS to a degree.

How patients' perceptions of symptoms affect outcome is still unclear (Whittaker et al, 2007) and it may be that beliefs about injury impact independently from diagnosis threat, given stereotype threat has been found to impact performance regardless of individual beliefs (Aronson et al, 1999). However, this question regarding the impact of illness beliefs requires further research using a sample where participants have more negative illness perceptions than in the current study.

5.4 The role of suggestibility

Results partially supported the hypothesis that suggestibility would impact susceptibility to diagnosis threat. Highly suggestible participants in the diagnosis threat arm experienced a greater performance decrement on one of the four neuropsychological tasks (WAIS-III Digit Span). The impact on this specific subtest may have been owing to differences in perceived difficulty of the task, although this has been found to be only weakly related to performance on research into other WAIS subtests (Katzmark, 2009). It may also be that a primacy effect was observed; the WAIS-III Digit Span was the first neuropsychological test to be administered, when threat instructions were still fresh and anxiety may have been higher.

This is a potential novel finding and bears replication, particularly given the effect was only found in one of the neuropsychological tasks. It is in line with the suggestion by Delis & Wetter (2007) that highly suggestible individuals may be especially prone to report higher levels of cognitive dysfunction, particularly in contexts that reinforce their beliefs in those deficits. It may also therefore be considered in wider studies of stereotype threat as a potential source of differences in response to the experimental paradigm.

5.5 Limitations

The current study had a number of limitations, many of which reflect shortcomings of the diagnosis threat literature as a whole. Although the current research made efforts to recruit a more representative study population than those employed in past research (which were often undergraduates) and of an at-risk group, participants recruited were still a fairly homogenous group with regards to age and professional background. As noted above, participant's sporting background may have resulted in the study population's mTBI injury beliefs not being representative of the wider mTBI population.

mTBI diagnosis was based solely on self-report, which has been found to be inaccurate (Kerr et al, 2015; Robbins et al, 2014). However, given such inaccuracies usually lead to underreporting

we would not expect this to have impacted our population sample. Additionally, given that the majority of the sample did not seek treatment, verification via other means (i.e. A&E notes) was not possible, and may have increased the risk of unblinding participants to study hypotheses.

The current study did not check whether participants were experiencing PCS symptoms, knowledge (and exclusion) of which may have helped help clarify how and on whom the diagnosis threat effect occurs. However, given recruitment was from a healthy, non-treatment seeking population, we would not expect ongoing mTBI complications to be present, and symptoms were not a focus of the current study. Additionally, measures of PCS often involve a comparison with pre-injury symptoms (such as the Rivermead PCS Questionnaire), which may have unconcealed the study hypotheses. The study also did not explicitly ask about multiple concussions, although these were reported by some participants. As with PCS symptoms, it was felt that undue focus on head injury details at the screening stage may have alerted participants to the nature of the study.

The current study did not include a healthy control arm as a comparator, which has been suggested in the wider stereotype threat literature, in order to be able to attribute any group differences to stereotype threat (Wheeler & Petty, 2001). However, the impact of diagnosis threat in mTBI remains an area of clinical interest irregardless of whether it is unique to the at-risk stereotyped group.

Inclusion of a number of post-experimental checks may have improved the data collected.

Blaine et al (2013) included a post-experimental probe as to whether participants remembered diagnosis threat instruction, which could have provided insight as to whether diagnosis threat had been adequately activated in our study. Additionally, inclusion of a suspicion probe (e.g. “Do you have any guesses about what the study is really about? We would be interested in hearing any ideas you might have”) to check whether participants were aware of the true

study hypothesis would have been informative, particularly given increased media coverage of mTBI in professional sports in the latter half of the data collection period (e.g. Katwala, 2014; Crouch, 2015). This was raised by a number of participants during the post-study debrief – for example asking about the impact of multiple concussions and referencing ongoing lawsuits regarding National Football League players – suggesting media coverage may have increased participant's awareness of sports-related concussion and possibly impacted expectations (Vanderploeg, Belanger & Kaufmann, 2014). Given the extent to which the diagnosis threat literature relies on a degree of misdirection as to the study hypotheses and focus, it is perhaps surprising that these probes do not feature in previous studies in the area.

Finally, in the absence of a self-report questionnaire on suggestibility, the GuCS was used. Although the GuCS is formally a measure of compliance, as opposed to suggestibility, the two constructs are closely related conceptually and research has shown a correlation between GuCS scores and suggestibility as measured by the GSS (Gudjonsson, 2003). Given the GSS has a quasi-experimental approach which might have interacted with the experimental process for threat versus controls it was not felt to be appropriate for the current study.

5.6 Future research

Although the current study was able to capture mTBI sufferers who do not present at hospital, it involved athletes, a population who tend to show good recovery following mTBI (Williams, Potter & Ryland, 2010). Future research should attempt to replicate findings in a community-based mTBI sample who may be more likely to be at risk of developing PCS.

Given the lack of negative beliefs and expectations found in our study population, another avenue for research would be a comparison of an athlete mTBI injury group with a non-athlete mTBI group to see if injury beliefs differ, and if there is a differential impact of diagnosis threat. An alternative experimental paradigm would be to compare uninjured athletes and non-

athletes on their B-IPQ scores of a hypothetical mTBI. This may shed light on whether injury beliefs do play a role in recovery and whether the good recovery found in the majority of sports-related mTBI are because of positive injury beliefs 'immunising' individuals from a diagnosis threat effect. The relationship between illness beliefs and diagnosis threat could also be further investigated by conducting a post-assessment B-IPQ, to see if diagnosis threat led to a change of participants' responses on the measure.

The current study asked subjects about their subjective cognitive abilities in general. Future studies may consider investigating participants' subjective report regarding specific cognitive test performance, as previous research has found a significant group difference in subjective performance (Suhr & Gunstad, 2002) and it may be that this is more sensitive to diagnosis threat effects than general reports.

Further research into suggestibility is needed to clarify the preliminary findings of this study. Given an effect was only seen on one neuropsychological test, replication is needed to improve confidence in the finding. The addition of a probe regarding perceived difficulty of each neuropsychological test may shed light on to why the interaction was seen on one neuropsychological test only. In addition, the role of suggestibility as a moderator of stereotype threat in general should be investigated.

Similarly, although the current study made efforts to improve ecological validity through its inclusion criteria (e.g. including those with a mental health diagnosis), further research looking at diagnosis threat effect in combination with other factors from the biopsychosocial model may help our conceptual understanding of PCS and provide greater clinical utility. It may be that PCS is a result of multiple factors (e.g. anxiety, negative beliefs) having a cumulative effect on vulnerable individuals.

5.7 Clinical implications

The current research failed to find an impact of diagnosis threat, which is in line with other research (Blaine et al, 2013; Ozen & Fernandes, 2010; Kinkela, 2008) and suggests a need to rethink the role of diagnosis threat in PCS. However, differences between the experimental and clinical environment should be taken into account before the potential impact of diagnosis threat is dismissed. For example, patients who are being assessed for genuine diagnostic purposes may be impacted by a range of different or additional social / contextual cues that may impact beliefs and expectations, for example adopting a 'patient' identity (Blaine et al, 2013).

Reducing the impact of diagnosis threat remains a challenge in clinical settings, given that individuals will typically be aware of their mTBI and the reason for undertaking neuropsychological testing. Nonetheless, it may be possible to reduce stereotypic cues from the environment, for example, negative expectations that may be implicitly communicated by the clinician, or to elicit and counter these where necessary during the assessment or in subsequent feedback sessions.

Further research into the possible role of injury beliefs is needed, as although situational factors such as diagnosis threat may be hard to actively control, there is evidence that beliefs about injury outcome (Silverberg et al, 2013; Comper et al, 2005; Borg et al, 2004; Mittenberg et al, 1996) and cognitive capabilities (Mikulincer, 2001) may be amenable to change.

Clinicians could therefore consider offering interventions that specifically target unhelpful beliefs about memory and concentration abilities.

Overall, clinicians should be aware of the range of biological, psychological and situational factors that may be at play in mTBI when interpreting performance on cognitive tests (McCrory et al, 2005) in order to tease apart the numerous factors potentially contributing to difficulties (Kosaka, 2006) and not fall prey to misattribution errors themselves.

6. CONCLUSION

The current review, when taken with previous literature, suggests the strength of diagnosis threat impact on neuropsychological test performance and subjective reports should be rethought. However, differences between the experimental paradigm and clinical settings should be taken into account and the effect should not be dismissed completely.

Injury beliefs were not found to impact the strength of diagnosis threat, although the lack of overtly negative expectations in the study population (i.e. athletes) make it hard to draw firm conclusions. The research opens up avenues for future research into whether mTBI injury beliefs in athletes differ substantially from those in the general population and whether such beliefs are protective in any way from ongoing PCS complaints. In addition, there is evidence that suggestibility plays a moderating role in the strength of diagnosis threat. Further investigation into this variable is needed in order to see whether it may be a potential source of differences in outcome across the diagnosis threat literature.

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8. APPENDIX

8.1 Appendix 1: Approach letter for sports clubs

Thinking skills, personality and self-beliefs in amateur sportsmen and sportswomen

Information Sheet for Sports Clubs

King's College Research Ethics Committee Ref: PNM/13/14-16

We would like to invite members of your sports club to participate in this postgraduate research project and were wondering if we would be able to approach those attending the club to let them know about this study taking place. Providing the researchers with the opportunity to discuss the current research with club attendees does not make them obliged to participate. Individuals can only take part if they want to and choosing not to take part will not disadvantage them in any way.

What is the purpose of the study?

Nowadays it is accepted that expert performance in sport is dependent on visual and thinking skills as well as on physical and motor capabilities. The area of visual skill has attracted significant interest in recent years (e.g. Williams et al., 1999), but, thinking factors have comparatively received less investigation.

We are interested in how amateur sportsmen and sportswomen perform on a series of short thinking tasks and the different factors affecting this. We hope that the project will provide new information about the relationship of different personality and environmental factors and the thinking performance of amateur sportsmen and sportswomen.

What are we asking to do?

We are inviting people who regularly engage in sporting activities to partake in the study. We are approaching sports clubs to ask if we can make attendees aware of the current research; this way we are able to ensure the people we approach are currently engaged in sporting activities on a regular basis.

By agreeing for the researcher to make club attendees aware of the research, the club is not committing its members to take part in the research. It is up to the individual to decide whether to take part or not. If someone does take part and change their mind at a later date, they will still be free to withdraw from the study at any time without giving a reason. Similarly, you are free to withdraw access of the researcher to the club at any time without providing a reason.

If you have any questions or require more information about this study please feel free to ask the researcher or contact them using the following details:

Sam Carter

Clinical Psychology, ASB

4 Windsor Walk, Denmark Hill

London, SE5 8BB

Tel: 0207 848 0433

Email: samantha.carter@kcl.ac.uk

I have read the information provided in the information sheet dated 1.11.13 (version 2) and am happy for the researchers to share information about the research study with members of the club.

Club name _____

Telephone No. _____

Email address _____

Name _____

Job Title _____

Signature _____

Date _____

8.2 Appendix 2: Consent to contact sheet

Thinking skills, personality and self-beliefs in amateur sportsmen and
sportswomen

I understand that by completing this questionnaire I am consenting to the researchers using the information provided for screening purposes and I am happy to be contacted to take part in the study if asked.

Name of Participant _____

Telephone No. _____

Email address _____

Signature _____

Date _____

8.3 Appendix 3: Information sheet for participants

Thinking skills, personality and self-beliefs in amateur sportsmen and sportswomen

Information Sheet for Participants

King's College Research Ethics Committee Ref: PNM/13/14-16

We will give you a copy of this information sheet

We would like to invite you to participate in this postgraduate research project. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information.

What is the purpose of the study?

Nowadays it is accepted that expert performance in sport is dependent on visual and thinking skills as well as on physical and motor capabilities. The area of visual skill has attracted significant interest in recent years (e.g. Williams et al., 1999), but comparatively, thinking factors have received less investigation.

We are interested in how amateur sportsmen and sportswomen perform on a series of short thinking tasks and the different factors affecting this. We hope that the project will provide new information on the impact different personality and environmental factors may have on the thinking performance of amateur sportsmen and sportswomen.

Who have we asked to participate?

We are inviting people who regularly engage in sporting activities to partake in the study. . We have contacted potential participants via a range of sports clubs in order to ensure the people we approach are currently engaged in sporting activities on a regular basis.

Only a proportion of individuals approached to complete the initial screening questionnaires have been invited to take part in the study. There are no negative implications associated with being asked to take part or not.

Do I have to take part?

It is up to you to decide whether to take part or not. If you do take part and change your mind at a later date, you will be free to withdraw from the study at any time without giving a reason. You may also withdraw any data/information you have already provided up until the data is analysed in April 2015.

What will I be asked to do if I do take part?

If you do decide to take part you will be asked to sign a consent form. You will still be free to withdraw at any time and without giving a reason. We will then ask you to carry out five brief tasks that look at attention and memory abilities and ask some questions about your attention, memory and mood in daily life. The whole session will last between 30-45 minutes.

When and where will the study take place?

Meetings can be arranged on a King's College London Campus or on sports club premises, whichever is most convenient. Meetings at sports clubs can coincide with training times where possible, but will be conducted on a one-to-one basis in a closed room, for purposes of privacy and to minimise distractions.

How long will the study last?

Recruitment for the study will be ongoing from March 2014 – March 2015. However, participants are only required to attend a single meeting, which lasts between 30-45 minutes.

No follow up meetings are required.

Are there any side effects, disadvantages or risks involved in participating?

The risks involved in participating are minimal. Some people may find the testing environment stressful. If there are questions that you find distressing, you are free to not answer those questions or to withdraw from participating.

Are there any benefits involved in participating?

As a thank you for your time, we will offer those that attend the second testing session £10 for participating in the study.

How will we maintain your privacy and confidentiality?

Everything you tell us will remain completely confidential within the limits of the law. No information you provide will be shared with your sports club. We will give you an identification number to replace *all* information we have in the data file that identifies your name, your address or any other contact details we have for you. The information that you give us will be completely anonymised and linked only to the numerical ID.

Your information – including your responses to questionnaires and task performance – will be stored in password protected documents, on a password protected computer. Paper documentation will be stored in locked filing cabinets. Your information will be stored in a separate place from the consent forms you will sign if you wish to partake in the study.

In rare circumstances, participants sometimes disclose behaviours that may put them at harm to themselves. In these cases the researcher may ask you to have a brief discussion with one of the supervisors of the study, to ensure your safety. However, we do not anticipate this being required.

What will happen to the results of the research study?

The research will go towards the completion of the researcher's Clinical Psychology doctorate. We also hope to publish the results of this research study.

Who has reviewed the study?

Psychiatry, Nursing & Midwifery Research Ethics Subcommittee of King's College London College Research Ethics has reviewed and approved this study.

Next Steps

It is up to you to decide whether to take part or not. If you decide to take part you are still free to withdraw from the study at any time and without giving a reason. You may also withdraw any data/information you have already provided up until April 2015.

If you do decide to take part you will be given this information sheet to keep and be asked to sign a consent form.

What if I have further questions?

If you have any questions or require more information about this study after you leave today, please contact the researcher using the following contact details:

Sam Carter
Clinical Psychology ASB
4 Windsor Walk
Denmark Hill
London
SE5 8BB
Tel: 0207 848 0433
Email: samantha.carter@kcl.ac.uk

If this study has harmed you in any way, you can contact King's College London using the details below for further advice and information:

Seb Potter (Academic Supervisor)
Lishman Unit
Maudsley Hospital
Denmark Hill
London SE5 8AZ
Tel: 020 3228 2092
Email: sebastian.potter@kcl.ac.uk

Kate Rimes (Second Supervisor)
Institute of Psychiatry
Box P077
De Crespigny Park
London SE5 8AF
Tel: 0207 848 0430
Email: katharine.rimes@kcl.ac.uk

8.4 Appendix 4: Breakdown of participant flow by club

Club ID	Sport	Gender	Completed GHS	Eligible	Consented	Completed
1	Boxing	Mixed	5	2	1	1
2	Boxing	Mixed	12	6	5	5
3	Boxing	Mixed	2	0	-	-
4	Boxing	Mixed	14	4	4	4
5	Boxing	Mixed	24	4	4	4
6	Boxing	Mixed	13	1	1	1
7	Boxing	Mixed	18	2	2	2
8	Boxing	Mixed	21	6	4	4
9	Boxing	Mixed	11	1	0	-
10	Boxing	Mixed	9	0	-	-
11	Boxing	Mixed	25	12	11	11
12	Boxing	Mixed	2	0	-	-
13	Boxing	Mixed	22	7	5	5
14	Boxing	Mixed	31	9	8	8
15	Boxing	Mixed	13	4	4	4
16	Boxing	Mixed	10	1	0	-
17	Rugby	Mixed	16	3	3	3
18	Rugby	Mixed	20	13	11	9
19	Rugby	Men's Team	22	13	12	12
20	Rugby	Men's Team	12	10	4	3
Total	-	-	302	98	79	76

8.5 Appendix 5: Letter of Full Approval from King's College London (KCL) College Research Ethics Committees' Psychiatry, Nursing & Midwifery Research Ethics Subcommittee (CREC)

Samantha Carter

Clinical Psychology

3rd Floor, Addiction Sciences Building

4 Windsor Walk, Denmark Hill

London SE5 8BB

12 December 2013

Dear Samantha

PNM/13/14-16 Thinking skills, personality and self-beliefs in amateur sportsmen and sportswomen.

Review Outcome: Full Approval

Thank you for sending in the amendments/clarifications requested to the above project. I am pleased to inform you that these meet the requirements of the PNM RESC and therefore that full approval is now granted.

Please ensure that you follow all relevant guidance as laid out in the King's College London Guidelines on Good Practice in Academic Research (<http://www.kcl.ac.uk/college/policyzone/index.php?id=247>).

For your information ethical approval is granted until 12 December 2016. If you need approval beyond this point you will need to apply for an extension to approval at least two weeks prior to this explaining why the extension is needed, (please note however

that a full re-application will not be necessary unless the protocol has changed). You should also note that if your approval is for one year, you will not be sent a reminder when it is due to lapse.

Ethical approval is required to cover the duration of the research study, up to the conclusion of the research. The conclusion of the research is defined as the final date or event detailed in the study description section of your approved application form (usually the end of data collection when all work with human participants will have been completed), not the completion of data analysis or publication of the results. For projects that only involve the further analysis of pre-existing data, approval must cover any period during which the researcher will be accessing or evaluating individual sensitive and/or un-anonymised records. Note that after the point at which ethical approval for your study is no longer required due to the study being complete (as per the above definitions), you will still need to ensure all research data/records management and storage procedures agreed to as part of your application are adhered to and carried out accordingly.

If you do not start the project within three months of this letter please contact the Research Ethics Office.

Should you wish to make a modification to the project or request an extension to approval you will need approval for this and should follow the guidance relating to modifying approved applications:

<http://www.kcl.ac.uk/innovation/research/support/ethics/applications/modifications>.

aspx

The circumstances where modification requests are required include the addition/removal of participant groups, additions/removal/changes to research methods, asking for additional data from participants, extensions to the ethical approval period. Any proposed modifications should only be carried out once full approval for the modification request has been granted.

Any unforeseen ethical problems arising during the course of the project should be reported to the approving committee/panel. In the event of an untoward event or an adverse reaction a full report must be made to the Chair of the approving committee/review panel within one week of the incident.

Please would you also note that we may, for the purposes of audit, contact you from time to time to ascertain the status of your research.

If you have any query about any aspect of this ethical approval, please contact your panel/committee administrator in the first instance

(<http://www.kcl.ac.uk/innovation/research/support/ethics/contact.aspx>). We wish you every success with this work.

With best wishes

Yours sincerely

Catherine Fieulleateau

Senior Research Ethics Officer

8.6 Appendix 6: General Health Screen used for screening purposesConfidential General Health Screen

Do you currently have or have a history of any medical condition(s)? (Please check all that apply)

- € Broken bones/fractures
- € Heart disease
- € Recent infection (chest, urinary tract, etc.)
- € Hypertension / High cholesterol
- € Diabetes
- € Osteoporosis
- € Respiratory / lung problems
- € Allergies
- € Thyroid problems
- € Cancer
- € Kidney problems
- € Epilepsy
- € Depression or anxiety
- € Skin diseases Other.....

Any surgeries:

Are you currently (now or in the last six months) receiving any on-going medical investigations or treatment for any condition? YES

NO

If yes, please specify

Are you taking any other regular medications (either prescription or non-prescription) at the moment? YES

NO

If yes, please specify

Are you awaiting any appointments with a specialist? YES NO

If yes, please specify

Are you currently going through any litigation or medicolegal claims in relation to any health problem or injury? YES

NO

Approximately how many unit of alcohol do you drink on average per week (where 2 units is a pint of medium strength beer or a large glass of wine)?

Are you a smoker? YES

NO

If yes, how much do you smoke per week on average?

Do you feel that you are generally physically fit?

YES NO

Have you sustained any physical injuries to your neck and/or back that needed any of the following:

- a) Emergency treatment (e.g. going to A&E)
- b) Treatment with your GP
- c) Treatment with another health professional (e.g. physiotherapy)

YES NO

If YES, please give brief details of the injury, how it happened, and the treatment you received (e.g. "lower back; playing rugby; 3 sessions of physiotherapy")

Date	Where was the injury?	How was the injury sustained?	What treatment did you receive?

Have you ever sustained any injuries to your head where either

- a) You were knocked unconscious?
- b) There was a gap in your memory for any length of time around the injury?

c) You felt dazed, confused or disorientated (e.g. concussion)?

YES NO

If YES, please give brief details, including estimates of any period of unconsciousness or gaps in your memory (e.g. "15-30 seconds" or "5 minutes")

Date	How was the injury sustained?	Did you lose consciousness? If so, for how long? Were you disorientated? If so, for how long?	Was there a gap in your memory after the injury? If so, for how long?	What treatment did you receive?

Have you sustained any other physical injuries other to you head, neck or back that needed any of the following:

- a) Emergency treatment (e.g. going to A&E)
- b) Treatment with your GP
- c) Treatment with another health professional (e.g. physiotherapy)

YES NO

If YES, please give brief details of the injury, how it happened, and the treatment you received (e.g. "broken arm; fell off a ladder; went to A&E – arm put in a plaster cast")

Date	Where was the injury?	How was the injury sustained?	What treatment did you receive?

8.7 Appendix 7: Debriefing letter

Thinking skills, personality and self-beliefs in amateur sportsmen and sportswomen

Debriefing Sheet for Participants

King's College Research Ethics Committee Ref: PNM/13/14-16

We will give you a copy of this debriefing sheet

We greatly appreciate your participation in our study and thank you for spending the time helping us with our research. When you began the study, you were told that its purpose was to examine thinking skills, personality and self beliefs in amateur sportsmen and sportswomen.

Now that you have completed the study we are able to provide with a more bit more information about what the study was looking at.

Symptoms caused by concussion tend to resolve within days or weeks. However, a small but significant group of people continue to report symptoms months and years post injury, without any clear biological reasons (i.e. there had been no visible damage to the brain). In these cases, psychological factors are thought to play a role in continuing symptoms. We are interested in one particular factor, which is whether people perform worse owing to an awareness of negative stereotypes relating to having a concussion or mild head injury. Therefore, the purpose of this study was to examine whether drawing attention to someone's prior head injury had a negative impact on their performance on thinking tasks. The study also looked at whether peoples' beliefs about their head injury made a difference to the degree of impact highlighting a concussion had on performance.

Individuals were selected on the basis of having sustained a concussion / mild head injury at any time in the past. Any information you were given about the effect of head injury on thinking ability is rarely found with individuals' suffering from a concussion / mild head injury. Some studies do find head injury effects on thinking skills, but these studies tend to include participants with more severe head injuries than those you reported experiencing in their past. Additionally, many individuals with a history of head injury don't experience thinking difficulties at all.

In order to collect the best data possible, we ask that you not discuss your experiences with any other people who potentially could be in this study until after recruitment ends. If people come into the study knowing about our specific predictions, as you can imagine, it could influence their results, and the data we collect would be not be useable. Also, since you will be given a copy of this debriefing sheet to take home with you, please do not make this available to other people.

If you have any questions about the study at a later date, please feel free to contact the researcher using the details below.

Sam Carter

Clinical Psychology

Addiction Sciences Building

4 Windsor Walk, Denmark Hill

London SE5 8BB

Tel: 0207 848 0433

Email: samantha.carter@kcl.ac.uk

8.8 Appendix 8: Questionnaire battery

ARCES & MFS

Daily functioning questionnaire

1. I have gone to the fridge to get one thing (e.g., milk) and taken something else (e.g., juice)

Never	1	2	3	4	5	Very
often						

2. I go into a room to do one thing (e.g., brush my teeth) and end up doing something else (e.g., brush my hair)

Never	1	2	3	4	5	Very
often						

3. I have lost track of a conversation because I zoned out when someone else was talking

Never	1	2	3	4	5	Very
often						

4. I have absent-mindedly placed things in unintended locations (e.g., putting milk in the pantry or sugar in the fridge)

Never	1	2	3	4	5	Very
often						

5. I have gone into a room to get something, got distracted, and wondered what I went there for

Never	1	2	3	4	5	Very often
-------	---	---	---	---	---	------------

6. I begin one task and get distracted into doing something else

Never	1	2	3	4	5	Very often
-------	---	---	---	---	---	------------

7. When reading I find that I have read several paragraphs without being able to recall what I read

Never	1	2	3	4	5	Very often
-------	---	---	---	---	---	------------

8. I make mistakes because I am doing one thing and thinking about another

Never	1	2	3	4	5	Very often
-------	---	---	---	---	---	------------

9. I have absent-mindedly mixed up targets of my action (e.g., pouring or putting something into the wrong container)

Never	1	2	3	4	5	Very often
-------	---	---	---	---	---	------------

10. I have to go back to check whether I have done something or not (e.g., turning out lights, locking doors)

Never	1	2	3	4	5	Very
often						

11. I have absent-mindedly misplaced frequently used objects, such as keys, pens, glasses, etc.

Never	1	2	3	4	5	Very
often						

12. I fail to see what I am looking for even though I am looking right at it

Never	1	2	3	4	5	Very
often						

13. I forget people's names immediately after they have introduced themselves

Never	1	2	3	4	5	Very
often						

14. I forget to pass on messages (e.g., phone messages)

Never	1	2	3	4	5	Very
often						

15. I forget what I went to the supermarket to buy

Never	1	2	3	4	5	Very
often						

16. I forget passwords

Never	1	2	3	4	5	Very
often						

17. I forget people's names, even though I rehearsed them

Never	1	2	3	4	5	Very
often						

18. I forget important dates like birthdays and anniversaries

Never	1	2	3	4	5	Very
often						

19. I forget appointments

Never	1	2	3	4	5	Very
often						

20. I forget to set my alarm

Never	1	2	3	4	5	Very
often						

21. I find I cannot quite remember something though it is on the tip of my tongue

Never	1	2	3	4	5	Very
often						

22. I remember facts but not where I learned them

Never	1	2	3	4	5	Very
often						

23. Even though I put things in a special place I still forget where they are

Never	1	2	3	4	5	Very
often						

24. I double-book myself when scheduling appointments

Never	1	2	3	4	5	Very
often						

BDI

Choose one statement out of the four statements in each question that best describes how you have been feeling over the past few days. Please circle your choice.

1. I do not feel sad.

I feel sad

I am sad all the time and I can't snap out of it.

I am so sad and unhappy that I can't stand it.

2. I am not particularly discouraged about the future.

I feel discouraged about the future.

I feel I have nothing to look forward to.

I feel the future is hopeless and that things cannot improve.

3. I do not feel like a failure.

I feel I have failed more than the average person.

As I look back on my life, all I can see is a lot of failures.

I feel I am a complete failure as a person.

4. I get as much satisfaction out of things as I used to.
I don't enjoy things the way I used to.
I don't get real satisfaction out of anything anymore.
I am dissatisfied or bored with everything.
5. I don't feel particularly guilty
I feel guilty a good part of the time.
I feel quite guilty most of the time.
I feel guilty all of the time.
6. I don't feel I am being punished.
I feel I may be punished.
I expect to be punished.
I feel I am being punished.
7. I don't feel disappointed in myself.
I am disappointed in myself.
I am disgusted with myself.
I hate myself.
8. I don't feel I am any worse than anybody else.
I am critical of myself for my weaknesses or mistakes.
I blame myself all the time for my faults.
I blame myself for everything bad that happens.
9. I don't have any thoughts of killing myself.

I have thoughts of killing myself, but I would not carry them out.

I would like to kill myself.

I would kill myself if I had the chance.

10. I don't cry any more than usual.

I cry more now than I used to.

I cry all the time now.

I used to be able to cry, but now I can't cry even though I want to.

11. I am no more irritated by things than I ever was.

I am slightly more irritated now than usual.

I am quite annoyed or irritated a good deal of the time.

I feel irritated all the time.

12. I have not lost interest in other people.

I am less interested in other people than I used to be.

I have lost most of my interest in other people.

I have lost all of my interest in other people.

13. I make decisions about as well as I ever could.

I put off making decisions more than I used to.

I have greater difficulty in making decisions more than I used to.

I can't make decisions at all anymore.

14. I don't feel that I look any worse than I used to.

I am worried that I am looking old or unattractive.

I feel there are permanent changes in my appearance that make me look
unattractive

I believe that I look ugly.

15. I can work about as well as before.

It takes an extra effort to get started at doing something.

I have to push myself very hard to do anything.

I can't do any work at all.

16. I can sleep as well as usual.

I don't sleep as well as I used to.

I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.

I wake up several hours earlier than I used to and cannot get back to sleep.

17. I don't get more tired than usual.

I get tired more easily than I used to.

I get tired from doing almost anything.

I am too tired to do anything.

18. My appetite is no worse than usual.

My appetite is not as good as it used to be.

My appetite is much worse now.

I have no appetite at all anymore.

19. I haven't lost much weight, if any, lately.

I have lost more than five pounds.

I have lost more than ten pounds.

I have lost more than fifteen pounds.

20. I am no more worried about my health than usual.

I am worried about physical problems like aches, pains, upset stomach, or constipation.

I am very worried about physical problems and it's hard to think of much else.

I am so worried about my physical problems that I cannot think of anything else.

21. I have not noticed any recent change in my interest in sex.

I am less interested in sex than I used to be.

I have almost no interest in sex.

I have lost interest in sex completely.

STAI

Your responses will be treated completely confidentially, and results will only be referred to in statistical form or anonymously.

Please read the following statements about how people feel in general. Circle the number that best describes how you generally feel. There are no right or wrong answers.

1 I feel pleasant

Almost never 1 2 3 4 Almost always

2 I feel nervous and restless

Almost never 1 2 3 4 Almost always

3 I feel satisfied with myself

Almost never 1 2 3 4 Almost always

4 I wish I could be as happy as others seem to be

Almost never	1	2	3	4	Almost always
--------------	---	---	---	---	---------------

5 I feel like a failure

Almost never	1	2	3	4	Almost always
--------------	---	---	---	---	---------------

6 I feel rested

Almost never	1	2	3	4	Almost always
--------------	---	---	---	---	---------------

7 I am 'calm, cool and collected'

Almost never	1	2	3	4	Almost always
--------------	---	---	---	---	---------------

8 I feel that difficulties are piling up so that I cannot overcome them

Almost never	1	2	3	4	Almost always
--------------	---	---	---	---	---------------

9 I worry too much over something that doesn't really matter

Almost never	1	2	3	4	Almost always
--------------	---	---	---	---	---------------

10 I am happy

Almost never	1	2	3	4	Almost always
--------------	---	---	---	---	---------------

11 I have disturbing thoughts

Almost never	1	2	3	4	Almost always
--------------	---	---	---	---	---------------

12 I lack self-confidence

Almost never	1	2	3	4	Almost always
--------------	---	---	---	---	---------------

13 I feel secure

Almost never	1	2	3	4	Almost always
--------------	---	---	---	---	---------------

14 I make decisions easily

Almost never	1	2	3	4	Almost always
--------------	---	---	---	---	---------------

15 I feel inadequate

Almost never	1	2	3	4	Almost always
--------------	---	---	---	---	---------------

16 I am content

Almost never	1	2	3	4	Almost always
--------------	---	---	---	---	---------------

17 Unimportant thoughts run through my mind and bother me

Almost never	1	2	3	4	Almost always
--------------	---	---	---	---	---------------

18 I take disappointments to heart and I can't put them out of my mind

Almost never 1 2 3 4 Almost always

19 I am a steady person

Almost never 1 2 3 4 Almost always

20 I get in a state of tension or turmoil when I think about my recent concerns and interests

Almost never 1 2 3 4 Almost always

EPQ

Does your mood often go up and down? YES / NO

Do you ever feel 'just miserable' for no reason? YES / NO

Are you an irritable person? YES / NO

Are your feelings easily hurt? YES / NO

Do you often feel 'fed-up'? YES / NO

Would you call yourself a nervous person? YES / NO

Are you a worrier? YES / NO

Would you call yourself tense or 'highly strung'? YES / NO

Do you worry too long after an embarrassing experience? YES / NO

Do you suffer from 'nerves'? YES / NO

Do you often feel lonely? YES / NO

Are you often troubled about feelings of guilt? YES / NO

GuCS

1. I give in easily to people when I am pressured YES / NO
2. I find it very difficult to tell people when I disagree with them YES / NO
3. People in authority make me feel uncomfortable and uneasy YES / NO
4. I tend to give in to people who insist that they are right YES / NO
5. I tend to become easily alarmed and frightened when I am in the company of people in authority YES / NO
6. I try very hard not to offend people in authority YES / NO
7. I would describe myself as a very obedient person YES / NO
8. I tend to go along with what people tell me even when I know that they are wrong YES / NO
9. I believe in avoiding rather than facing demanding and frightening situations YES / NO
10. I try to please others YES / NO
11. Disagreeing with people often takes more time than it is worth YES / NO
12. I generally believe in doing as I am told YES / NO
13. When I am uncertain about things I tend to accept what people tell me YES / NO

14. I generally try to avoid confrontation with people YES / NO

15. As a child I always did what my parents told me YES / NO

16. I try hard to do what is expected of me YES / NO

17. I am not too concerned about what people think of me YES / NO

18. I strongly resist being pressured to do things I don't want to do YES / NO

19. I would never go along with what people tell me in order to please them YES / NO

20. When I was a child I sometimes took the blame for things I had not done YES / NO

Part 3

SERVICE EVALUATION PROJECT

An evaluation of formulation groups
running on older adult inpatient wards

Samantha Carter-Allison

Institute of Psychiatry, King's College London

Supervised by:

Dr Patrick McGuinness

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1. ABSTRACT

Background: Staff formulation groups have been posited as one way clinical psychologists can have a wide ranging impact on the care of complex patients. This evaluation explored staff views on the acceptability and impact of formulation groups running on three Older Adult inpatient wards.

Method: Forty-five satisfaction questionnaires were completed by ward staff over the 6 month period of June-December 2013. In addition, focus groups were conducted across all three wards at the end of the 6 month evaluation period.

Results: High levels of satisfaction with the usefulness and impact of the formulation groups were reported by staff. Suggestions for improvements related to the structure and flexibility of the group, improved communication of group outcomes, revisiting formulations, providing feedback on group impact and increasing awareness across the ward.

Conclusions: Formulation groups were viewed in a positive light by staff. Recommendations made will contribute to the development of the groups on the wards. Limitations of the current evaluation are discussed and should be considered when conducting future evaluations.

2. INTRODUCTION

2.1 Overview

The project aimed to ascertain staff views on psychological formulation groups that were running on the Older Adult inpatient wards within South London & Maudsley NHS Foundation Trust (SLaM). The formulation groups were initiated in 2011 with the aim to get staff thinking more psychologically about patients and, in turn, apply such thinking to their day to day work. By collecting staff views on the formulation groups, we were able to see if these aims were being met, whether staff found the groups acceptable and useful, and if so in what ways.

Staff satisfaction was examined as part of a larger investigation on the impact of the formulation groups on the wards. The second part of the enquiry – which looked at the impact of the formulation groups on care plans, and therefore patient care – will not be reported in this write-up.

2.2 Rationale

In the British Psychological Society (BPS) report “*Estimating the applied psychology demand in adult mental health*” (Lavender & Paxton, 2004), a significant gap between supply and demand for clinical psychologists was identified. At the time it was estimated that although the demand for clinical psychologists was approximately 7,300 whole time equivalent (WTE), there were only 4,850 WTE clinical psychologists (6,100 individuals) in the NHS. The report also emphasised that the need was probably greater once key specialities, such as children’s services and services for older people, were taken into account, and that they expected the gap to worsen. More recent figures state that there were around 6,900 WTE clinical psychologists working in all specialities in the NHS in 2010 (Centre for Workforce Intelligence, 2012). The CfWI notes that their estimate may be inflated, owing to other applied psychologists working within the NHS – such as health psychologists and forensic psychologists – having to code themselves as clinical psychologists, owing to limited occupation codes in the NHS.

Although Lavender & Paxton recommended that annual growth of the profession be increased from 9% to 15% to remedy the gap, data shows that planned commissioning has stayed relatively stable, with about the same number of training places planned in 2012/13 as in 2007/08 (Leeds Clearing House). Despite the stability of numbers coming into the profession, the population served has been growing; the 2011 census places the population of England at around 53 million, an 8% increase since 2001 (Office of National Statistics, 2011). Therefore it

may be reasonable to presume that the supply-demand gap has widened, as Lavender & Paxton forecast.

Given the above discrepancy, Lavender & Paxton recommended that applied psychologists “need to assess where there are current gaps in psychological provision, for example the relative dearth of clinical psychologists in acute psychiatric settings, and endeavour to find ways to fill such gaps”. They saw this as involving the dissemination and promotion of psychology in teams, through “teaching, supervision, consultation and the production and dissemination of guidance materials”, in order to use psychologists’ specialist knowledge and skills more effectively.

Christofides et al (2012) suggests that training other people in teams to think psychologically may be one way the scarce resource of the clinical psychologist can effectively make an impact on the care of complex service users. Many places clinical psychologists work, for example inpatient settings, often adhere strongly to a medical model, which it is argued can hinder recovery owing to the adoption of the service user of the “patient role” (Onyett, 2007). Additionally, providing a psychosocial perspective as an alternative may appeal to staff in settings where the current model of thinking has left staff feeling frustrated and stuck (Hood et al, 2013).

Formulation is one tool clinical psychologists use to draw together biological, psychological and social factors that may contribute to a service user’s distress. Formulation refers to a working hypothesis of a person’s difficulties that incorporate how their core problems developed and are maintained and indicate a plan of intervention based in the psychological processes and principles identified (Division of Clinical Psychology (DCP), 2011). It is a core competency within clinical psychology and is often seen as a defining skill in the profession (Kinderman, 2001). The DCP report “*Good practice guidelines on the use of psychological formulation*” (2011) states

that clinical psychologists should be “using, sharing, promoting and offering training in formulation and formulating within multi-disciplinary teams (MDTs)”.

In recent years there has been an emerging evidence base for the use of formulation groups within MDTs (e.g. Lake, 2008; Davenport, 2002; Berry et al, 2009). While most research reports high levels of staff satisfaction with these groups, some have raised the question of the impact they have on day to day work (Summers, 2006). Chadwick et al (2003) described the evidence for case formulation as “limited and conflicting”.

The current project was conducted to investigate staff opinions on the benefit and impact of formulation groups that were run on a regular basis on the three inpatient wards under the Mental Health of Older Adults & Dementia Clinical Academic Group (MHOA CAG) in SLaM. Findings have implications for whether the formulation groups continue to run on the wards with the same frequency and how information from the groups is disseminated.

2.3 MHOA inpatient wards

2.3.1 Structure of wards

The project was carried out across three MHOA inpatient wards within SLaM; Chelsham House, a 20 bed ward in Bethlem Royal Hospital, Aubrey Lewis 1 Ward (AL1), a 20 bed ward at the Maudsley Hospital, and Hayworth Ward, an 18 bed ward in the Ladywell Unit at University Hospital Lewisham.

All three wards care for older adults who are admitted to hospital in a crisis, and provide assessment, treatment and care, up to and including support with moving back into the community. Service users on the ward are men and women over the age of 65 with an acute mental health problem, organic or functional. This includes people who have a relapse of a long-term mental illness and those who, due to the level of identified risks to themselves or

others, cannot be safely assessed and treated anywhere but in an acute mental health hospital. The wards also admit people under the age of 65 with a diagnosis of dementia and an acute mental illness, or who are suspected to have an acute mental illness. Individuals that require a higher level of security or have complex physical health care requirements are not able to be supported on the wards and are referred elsewhere.

Referrals are accepted from across the London Boroughs of Southwark, Croydon, Lambeth and Lewisham. In addition, Chelsham House has a limited number of beds for national referrals. Admissions to the wards may be formal (detained under the Mental Health Act of 1983) or informal

Interventions offered on the wards include mental and physical health assessments; risk assessment; care planning, including work with families and carers; medication reviews; group and individual psychological therapies; support and advice to meet physical health care needs; health promotion and education; relapse prevention and health management strategies. Treatment aims to stabilise the person as quickly as possible, so that hospital care is no longer required. Education about the nature of an individual's illness is also a priority, especially if they are being hospitalised for the first time.

2.3.2 Psychology & psychotherapy on the wards

At the time of the service evaluation, there were 1.6 WTE clinical psychologists covering the three inpatient wards, and 0.4 WTE psychological therapists. A locum member of staff was covering maternity leave on one ward. The team was augmented by clinical psychology trainees, drama therapy trainees and assistant psychologists.

Psychological intervention on the wards is delivered both through individual and group contact. The majority of individual therapy is cognitive behavioural therapy (CBT), although

other therapeutic options are also offered, such as dramatherapy, psychoanalytically based therapy and systems based therapy. In addition, half of all direct patient contacts are through therapeutic groups, such as the CBT-based “Managing Mood” and dramatherapy for both cognitively intact patients and those with dementia.

In order to supplement direct clinical contact, the psychology team has worked towards consolidating the importance of psychological formulation skills amongst the inpatient staff teams. In 2012, one day formulation training workshops were set up for staff at Hayworth and Chelsham, which pre-empted the regular formulation groups that are being evaluated in this project.

2.4 Formulation

2.4.1 Conceptualising and Defining Formulation

Although often described as a defining skill of clinical psychologists (Kinderman, 2001), there is no universally agreed definition of formulation and the term means different things in different professions (DCP, 2011). Within clinical psychology, Johnstone & Dallos (2006) describe formulation as “a hypothesis about a person's difficulties, which draws from psychological theory”, while Butler (1998) sees it as “the lynchpin that holds theory and practice together”.

A main aim of any formulation is to identify the best way forward in terms of intervention. However, it can serve a number of other purposes, such as clarifying hypotheses and questions, ensuring that the service user has felt heard and incorporating cultural understanding. *The core purpose and philosophy of the profession* report (DCP, 2010) identified several features a good formulation should include: summarising the core problems; suggesting how difficulties may relate to one another by drawing on psychological theories and principles; aiming to explain the development and maintenance of difficulties; indicating a plan

of intervention based on psychological processes and principles identified; and being open to revision and re-formulation.

There is a strong emphasis within the discipline on formulation being “a provisional working hypothesis, intended to be open to revision” (Christofides et al, 2012). Given the DCP's (2010) recommendation that psychologists should be drawing on a number of models, formulation may even comprise a number of provisional hypotheses.

2.4.2 *Formulation in MDTs*

Although traditionally formulations are constructed collaboratively with clients in individual therapy, the use of formulation in multidisciplinary teamwork is becoming more commonplace. A number of professional documents recommend this way of working, such the Clinical Psychology Leadership Framework (Skinner & Toogood, 2010) and the Health & Care Professions Council criteria (Health Professions Council, 2009). The Department of Health (1999) also advises on creating a shared formulation among the team in order to aid communication and have clear agreement among health and social services. The BPS report *New ways of working in teams* (Onyett, 2007) – which offers direction on the role of clinical psychologists in MDTs – highlights psychological formulation as an important tool to guide interventions, enable change and support recovery.

Christofides et al's (2012) investigation of how psychologists employ team formulation in MDTs, a substantial number of responses indicated that it was delivered via informal channels, such as making suggestions in team meetings and case discussions, and informal conversations about clients. For the purpose of this project, formulation refers to a more formal and explicit delivery of formulation to teams, namely the running of regular formulation meeting for the whole of the ward staff.

2.4.3 *Benefits of team formulation*

The *Good practice guidelines on the use of psychological formulation* (DCP, 2011) lists numerous benefits of team formulation. These include (but aren't limited to) achieving a consistent team approach, gathering key information, generating new ways of thinking, dealing with issues beyond crisis management, supporting each other with complex cases and drawing on the expertise of all team members. Hollingworth & Johnstone (2013) conducted an audit of team formulation work by asking staff to rate formulation groups running within community and inpatient adult mental health services on each of the purported benefits listed by the DCP. All responders felt the groups helped with developing a shared understanding of the client's strengths and difficulties, drew on a range of expertise and generated new ideas for intervention and managing risk.

Improvements in communication within the team has been highlighted by Lake (2008) as a potential benefit, who reported that a simple formulation template created by the MDT provided a "common language" and structure that was shared across the diverse staff group.

Davenport (2002) undertook a case formulation of a client on admission onto a low secure rehab setting and concluded that it helped emphasise to staff the impact of the inpatient environment on service users, particularly in terms of attachment styles. Such increases in understanding can shape staff perceptions of a patient's mental health problems, which can in turn lead to more positive relationships with service users (Berry et al, 2009). Similarly, in an evaluation of staff views of psychological formulation groups on an acute older adult inpatient mental health ward, Wainwright & Bergin (2010) reported increases in staff empathy, understanding and tolerance.

Research has also highlighted the impact of team formulation on staff well-being. Davenport (2002) sees formulation as having the potential to improve team cohesion, job satisfaction and staff turnover, while an investigation into the impact of formulation meetings on a psychiatric rehabilitation unit found staff reported greater confidence in their work (Berry et al, 2009). A sense of emotional containment from feeling there is a way forward with even the most complex cases has also been cited as an important outcome following team formulation (Dexter-Smith, 2010). At the very least regular formulation meetings “provides a space in the team for both thinking and processing feelings” (Johnstone, 2013), which is rare in busy teams .Given the medical model is dominant in many MDTs, many researchers have focussed on how psychological formulation can offer an alternate perspective. Both Summers (2006) and Onyett (2007) see team formulation as a powerful way of shifting staff culture to a more psychosocial perspective. This can be powerful for both staff - who may feel “stuck” with how to move forward with the current model of thinking within the team - and for service users, who may gain a greater sense of agency and hope, empowering them to recover rather than relying on medical interventions (Christofides et al, 2012). By avoiding the medicalisation of people's difficulties, the risk of offering interventions that do not address their core difficulties is also reduced (Johnstone, 2013).

As Borrill & West (2002) point out, many of the benefits listed by the DCP overlap with attributes of good team working in general, therefore it may be reasonable to suggest that the use of formulation may contribute to more effective team working across the board. However, despite the cited benefits, formulation is “still fighting for recognition as a useful way for understanding the person's issues” (Hood et al, 2013).

2.4.4 Staff views on formulation

Despite overwhelmingly positive outcomes from research into formulation groups, some staff responses towards this way of working have been mixed. In a one year audit of an inpatient formulation group, Kennedy, Smalley & Harris (2003) found staff reported positive attitudes toward the psychological input on a tick-box questionnaire. However, Summers (2006) found staff held a more cautious opinion of formulation. Staff interviewed on the use of formulation groups within a high-dependency rehabilitation unit found formulation useful in guiding interventions, improving staff-patient relationships and increasing team cohesion, but also felt ideas were sometimes too speculative and had limited impact.

Perhaps one of the most influential proponents for team formulation is Sarah Dexter-Smith, whose model for integrating CBT formulation into two older adults inpatient unit is now used across the whole Older Adult service in Tees, Esk & Wear Valleys NHS Foundation Trust (Dexter-Smith, 2010). It should be noted while much of the research focuses on running MDT formulation groups, Dexter-Smith's focus was on training staff to implement formulation. Overall, staff provided positive feedback about the training, but despite this the researchers reported difficulties implementing and embedding formulation into the service (Craven-Staines et al, 2010).

2.4.5 Barriers to the use of formulation

There have been implications in the literature that action points from formulation meetings do not get carried out in practise (Wainwright & Bergin, 2010; Summers, 2006). There have been a number of suggestions as to why this may be, including a lack of confidence among staff to independently implement formulation (Craven-Staines et al, 2010) or a lack of time. Down (2010) suggests that formulation time gets “eroded” by other staff demands, with crisis management or shift patterns preventing attendance, which can lead to action points developed in groups not being adopted across the board.

Down's observations point towards a "culture clash" between formulation and how wards are run. For example, case formulation can often come into conflict with the medical model, particularly when medical decisions, such as diagnosis, have psychological implications. (Johnstone, 2013). Other researchers have reported resistance from staff, particularly if the aim of formulation meetings is not sensitively explained (Christofides et al, 2012; Craven-Staines et al, 2010).

For team formulation to become embedded in ward culture and be seen as valuable there is a need to document specific outcomes, such as reductions in medication use, shorter admissions, less staff sickness, service user recovery rates and better identification and management of risk (Johnstone, 2013). The impact of formulation must be made explicit, with robust links to care planning being made (Summers, 2006) and it needs to be supported by influential members of the team (Lake, 2008). Craven-Staines et al's (2010) finding about staff lack of confidence also makes an argument for ongoing support, facilitation or supervision from a psychologist.

2.5 Formulation groups on the wards

2.5.1 *Setting*

On two of the wards, 60 minute formulation groups ran fortnightly. On the third ward, formulation groups ran on a monthly basis, owing to the lack of a permanent ward psychologist over the period evaluated. Formulation groups were open to all staff and were facilitated by the ward psychologist, with the exception of one ward, where the facilitator role was shared with the psychologist and the drama therapist, who was trained in psychodynamic therapy. All attendees were encouraged to contribute their individual experiences of working with the client and generate ideas that might contribute to the formulation.

2.5.2 *Picking the person discussed*

The facilitator of the formulation groups would approach staff the morning the group was to run to ask who they would like to discuss. The staff then decided amongst themselves and told the facilitator who they wanted to discuss. Staff reported keeping the formulation group in mind when dealing with clients, in order to have a clear shared idea of who would be most helpful to formulate when the facilitator asked. If no suggestions were made, the facilitator would make suggestions based on their knowledge of the ward.

2.5.3 *Structure*

The structure of the formulation groups followed a CBT framework, based on Beck's cognitive formulation (Beck et al, 1979). This included a longitudinal component, where staff collated information known about the client's history - including family, educational and working background - and thought about how past events may shape current behaviour. This included speculating about a client's core beliefs (I am ... / people are ... / the world is ...) and dysfunctional assumptions (e.g. If I am aggressive, then no one will take advantage of me).

The second component of the formulation group focussed on factors maintaining the behaviour that staff were finding challenging. The Hot Cross Bun model (Padesky, 1993) was used to think about how a client's thoughts, feelings, behaviour and bodily sensations may be influencing one another.

Once a better understanding had been gained from the longitudinal and maintenance formulations, staff were encouraged to share methods they had found effective in managing difficult behaviour or speculate on what may help given what had been learnt about their background. From this, practical steps to try out were suggested, with the aim of modifying

client behaviour or improving staff-client relationships. On one ward this was done by “brainstorming” as many ideas as possible, and then choosing a few key action points staff felt were most feasible to carry out. The group template can be found in Appendix 1.

Although groups were devised around a CBT framework, facilitators also drew on systemic and psychodynamic ideas to differing degrees. These included introducing ideas around attachment styles and the replaying of past and present relationships within the ward setting, the role of the “patient” on the ward and the impact of transference and countertransference. Each part of the formulation group was written up in rough textual and diagrammatic form as it was discussed during the group. Formulations were not explicitly discussed with the patient, although any resulting changes to care plans were shared with patients where possible / appropriate.

2.5.4 Dissemination

After the group the formulation was written up by the facilitator and uploaded onto the electronic patient data programme used by SLaM. On one ward the facilitator also emailed the formulation to all ward staff. In addition, action points were shared between nursing staff at shift handover. The key nurse for the patient discussed was notified (if they had not personally attended) and was responsible for updating the patient's care plan to reflect information from the formulation group. On one ward, staff also discussed information from the formulation group during ward rounds.

2.5.5 Aims of formulation groups

The ongoing formulation groups on the ward aim to improve formulation skills among the inpatient staff team, in order to reap the benefits highlighted by the literature for both staff

and service users. It is hoped that ongoing formulation groups will contribute to the establishment and consolidation of psychological thinking on the wards.

2.6 Aims of the study

The aims of the evaluation were:

Aim 1: to gain quantitative feedback on how staff feel about the formulation groups via satisfaction questionnaires.

Aim 2: to gain more detailed qualitative information from ward staff by running semi-structured focus groups across the three wards

3. METHOD

3.1 Participants

All staff working on the three MHOA inpatient wards were asked to complete staff satisfaction questionnaires, regardless of whether they had attended a formulation group. Staff who had not attended a group were asked to write what stopped them attending.

For the focus groups, ward managers emailed staff notifying them that focus groups would be running and asking for volunteers to attend to represent each staff group. In actuality, on two of the wards focus groups attendees were those who were available at the time, resulting in a higher number of nursing staff attending.

3.2 Design & Procedure

The formulation groups were evaluated over a 6 month period. The evaluation period did not coincide with the start of the formulation groups running on the ward, which had been around a year prior. Staff opinions were collected via a number of methods.

A satisfaction questionnaire designed to gauge staff satisfaction with the groups was administered at two time points over the 6 month evaluation period, at the start and the mid-point (see Appendix 2.). The questionnaire consisted of 11 questions; 6 of which asked staff to rate aspects of the group on a 5-point Likert scale and 5 of which gave staff the opportunity to contribute qualitative information on their view of the groups. Questionnaires were completed anonymously and were submitted to the ward manager or team psychologist, who then sent them on to the researcher.

In addition to the questionnaires, focus groups were run on each ward at the end of the evaluation period, to gain richer data on staff views of the formulation groups. A semi-structured interview technique was used, with prompt questions to start discussion on different aspects of the groups (see Appendix 3.). This method was employed in order to place minimal constraints on focus group participants, thus allowing for unexpected responses and different perspectives (Hayes, 1997).

Focus groups were run on the wards, in lieu of the formulation group. They lasted for approximately 45 minutes and tea and biscuits were provided in order to create an informal atmosphere. The researcher acted as the facilitator of the focus groups. Although a trainee psychologist, the researcher was not based on any of the inpatient wards and was not known by ward staff; it was hoped that by having a facilitator not associated with the formulation groups, staff would feel more able to provide honest opinions and not be coloured by the presence of the formulation group facilitators.

Ward managers did not attend focus groups, in order to make staff feel more comfortable and confident to provide honest, anonymous feedback. However, ward managers were interviewed individually to gauge their opinions on the formulation groups and their comments were combined and analysed with feedback from the focus groups.

3.3 Thematic analysis

Thematic analysis was used to analyse both responses from the non-Likert questions on the satisfaction questionnaire and data collated from the focus groups. The thematic analysis followed the procedure outlined by Braun & Clarke (2006).

Questionnaire responses were copied verbatim to an Excel. When documenting the focus groups, the researcher recorded the responses in writing, verbatim where possible, which were then uploaded to an Excel. The researcher read the transcripts a number of times before labelling individual data extracts with broad codes, pertaining to whether the sentence reflected formulations groups' strengths, weaknesses or possible recommendations for improving the groups. Within this, data was sorted into provisional themes. Data labels and extracts were then sent to the research supervisor and another research psychologist to compare themes they deemed relevant.

3.4 Ethical approval

An Audit & Service Evaluation Project Proposal was submitted to the Clinical Effectiveness & Service Improvement Committee for the MHOA CAG. Both the committee and Information Governance approved the project and deemed that, owing to the absence of direct client contact, approval from the Research Council was not necessary. The study received approval for one year, from June 2013 to June 2014.

3.5 Researcher's stance

At the end of the evaluation, the researcher was a second year trainee clinical psychologist, who held a biopsychosocial understanding of mental distress. She had experience of using formulation within individual therapy and informally within teams across a range of NHS settings and felt it had a positive effect on client care. Although she had not facilitated a

formulation group, she had attended as an observer and been in frequent correspondence with the facilitators of the groups. The research supervisor was also a clinical psychologist and the facilitator of a formulation groups on one of the wards.

Although steps were taken to reduce staff responses being shaped by a “self-preservation bias” (Adams et al, 1999) – giving what they may deem as “acceptable” or “socially desirable” views – the researcher's position of being associated with psychology may have still influenced interviews, while the researcher's prior interest and belief in the value of formulation may have impacted analysis. However, the internal coherence of responses across different wards and data collection methods, and the voicing of negative and unexpected views add validity to the findings.

4. RESULTS

4.1 Satisfaction surveys

Across the three wards, a total of 29 staff completed the satisfaction questionnaire at time point one (T1) and 16 staff completed it at time point two (T2). It should be noted that not all the questionnaires returned were fully completed; in particular those returned by staff that had not attended the formulation often only contained responses to qualitative questions. Three questionnaires at T1 and one questionnaire at T2 were returned by staff members who had not attended the formulation group.

Pie charts presented below reflect staff opinion from both T1 and T2. Given that the evaluation did not start when the formulation groups commenced, and that we were not expecting or looking at change in opinion between T1 and T2, this was felt to be the best way to present the data.

4.1.1 Staff breakdown of completed questionnaires

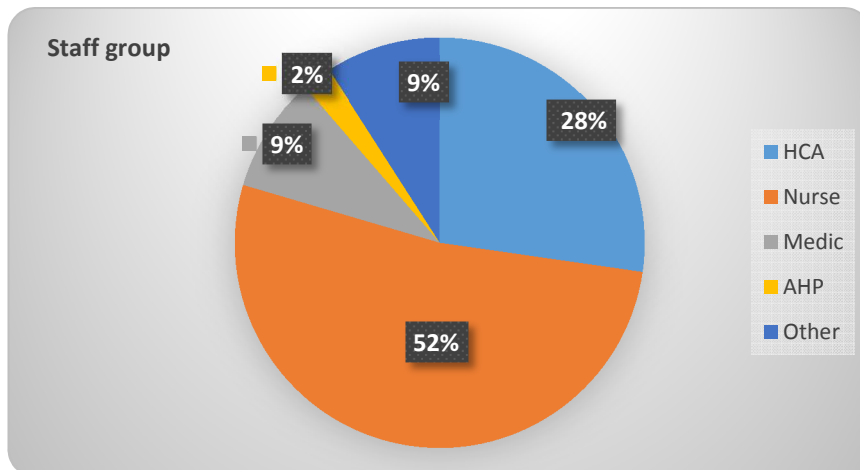


Figure 1a. Breakdown of survey responders by staff group at T1 and T2 combined

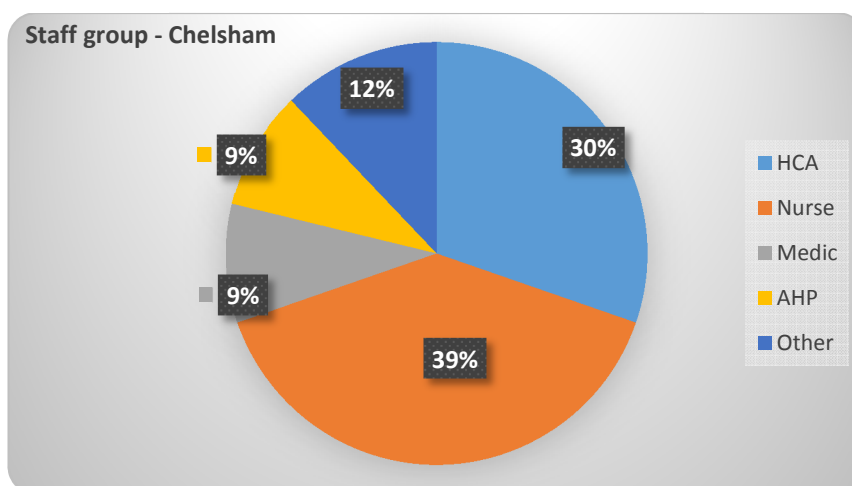


Figure 1b. Breakdown of Chelsham MHOA inpatient ward by staff group

Figure 1a. shows the breakdown of survey responses by staff group. The breakdown of responders appear to reflect the general breakdown of the older adult wards by staff group (Figure 1b.). Allied Health Professionals appear to be under-represented in the satisfaction survey responses; we can understand this by the fact that this staff group includes psychologists, most of whom were involved in the service evaluation and the running of the formulation groups and therefore did not fill out the questionnaires. Given questionnaires

were completed by both attendees and non-attendees of the formulation groups, we are not able to draw conclusions about the staff split of formulation group attendees.

Questions 1 & 2 - How satisfied are you with the structure of the meetings? Do you have any suggestions for how we could improve the structure of the meetings?

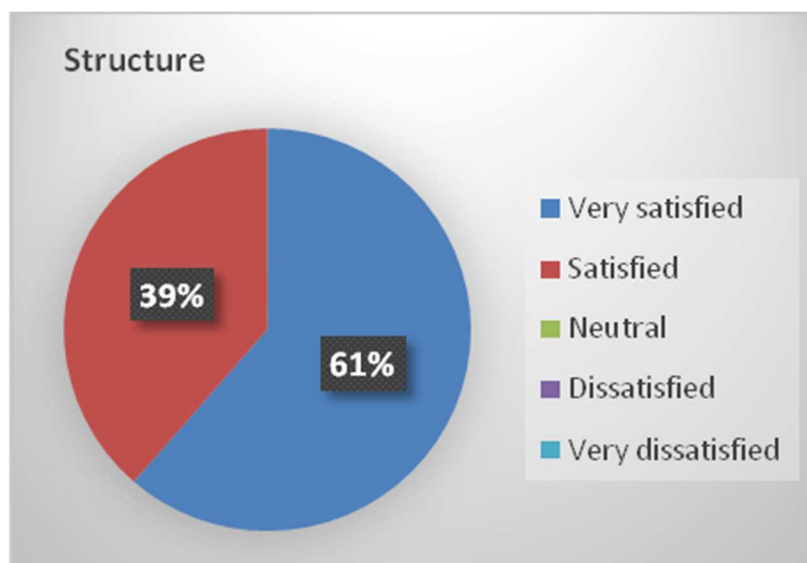


Figure 2. Staff satisfaction with the formulation group structure T1 and T2 combined

Overall, staff provided overwhelmingly positive feedback with regard to the structure of the formulation groups (i.e. longitudinal formulation; hot cross bun; action points), with all responders stating they were either “satisfied” or “very satisfied” with this aspect of the group.

Recommendations made by staff regarding the structure focussed on ensuring enough time was given to each session (“clarify how much time will be spent discussing different aspects of the case at the beginning”) and suggestions that greater preparation prior to meetings may increase efficacy (“Add in printed summary of patient under review for use in formulation

meeting”; “Knowing the patient to be discussed would be helpful, as I may try to gather some information before the meeting”).

Questions 3 & 4 - How satisfied are you with the time and day of the meeting? Do you have any suggestions for alternative times?

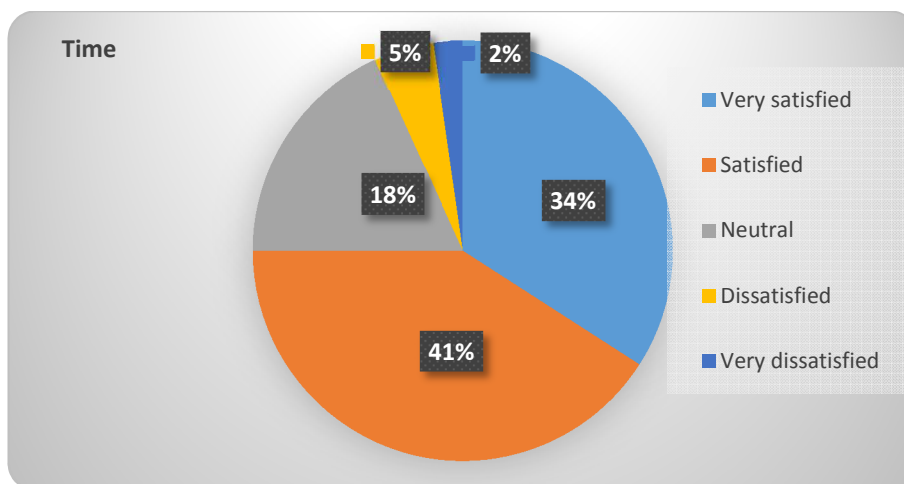


Figure 3. Staff satisfaction with the timing of the formulation group T1 and T2 combined

On all three wards, formulation groups ran immediately after the nurse’s change-over meetings, in order to maximise the number of staff able to attend. Satisfaction was variable among responders, with many reporting shift patterns and workload making the time unfeasible (“it’s just pot luck if your shift meets the formulation meetings”; “I cannot attend the meeting as it is a training day at IOP”). However, there was also recognition as to why the group ran at the current time and a lack of other options (“presume having group during nursing shift improves staff availability”)

Question 5 - How comfortable do you feel about contributing within the meeting?

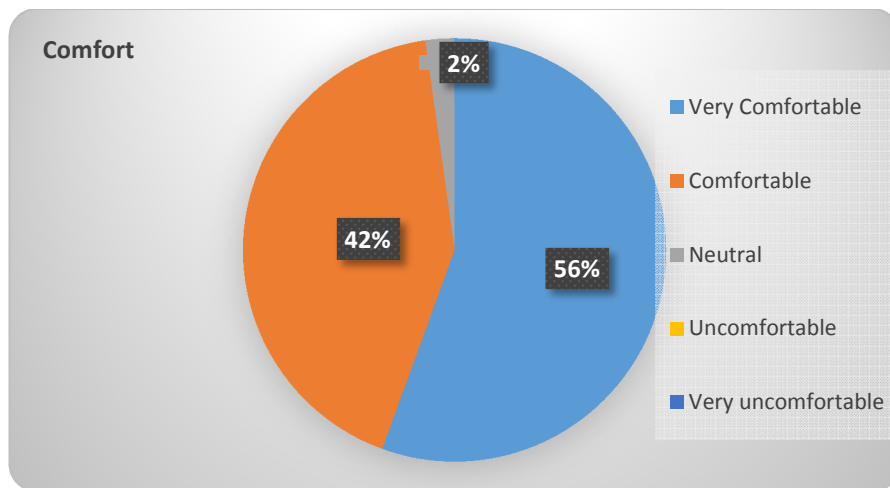


Figure 4. Staff comfort at contributing to formulation group T1 and T2 combined

98% of staff reported feeling “comfortable” or “very comfortable” contributing to formulation meetings, suggesting the group had been able to foster an atmosphere of informality and equality.

Questions 6 & 7 - How satisfied are you with the outcomes and objectives produced by the meeting? Do you have any suggestions for how we could improve the outcomes and objectives?

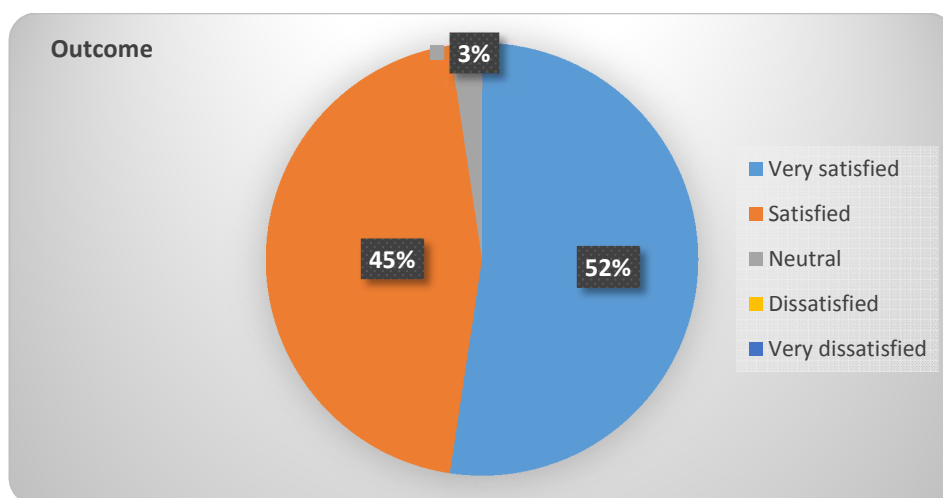


Figure 5. Staff satisfaction with the outcomes of the formulation group T1 and T2 combined

97% of staff were “satisfied” or “very satisfied” with the action points developed in the meetings, with positive comments made regarding the impact on care plans specifically (“satisfied it helps care plans and patient wellbeing”; “helps good care planning”).

Recommendations made revolved around improving the implementation of action points (“ensure primary nurse is aware to reflect outcomes in care plans”; “connect this meeting with ward rounds and doctor's meetings on Mon”).

Question 8 & 9 - How much do the meetings influence your work with the patients discussed?

Can you describe anything you have done differently with individual clients because of the meetings?

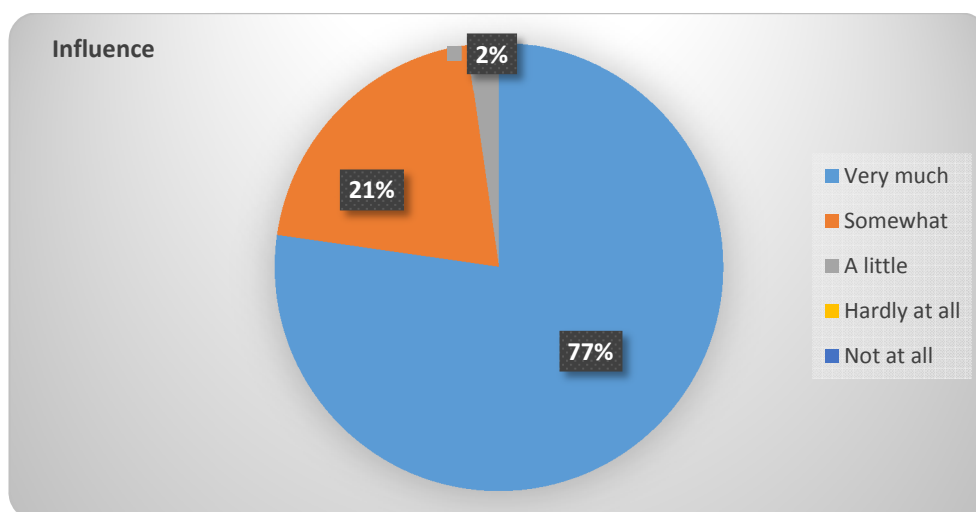


Figure 6. Perceived impact of formulation group on staff working T1 and T2 combined

Importantly, all survey responders stated that attending formulation groups had an impact on the way they worked, with over three quarters reporting that the impact had been “very much”.

When describing changes or improvements instilled by group attendance, responses included improved care planning (“I was able to review the patient care plan and discuss with team, taking account of risk issues and raise any concerns”), greater person centred care (“... we get a picture of the person not as a patient”), changes to the way issues are approached (“I have used group outcomes when interacting with clients e.g. responding to client before aggression starts”) and increased sharing of information (“I go away knowing more about the patient, especially their history”). However, it should be noted that some responses reflected a feeling that there was little added benefit from the formulation group (“all that has been discussed is already done with our duties”).

Question 10 - In general, how helpful do you find the hot-cross bun formulation used in the meetings?

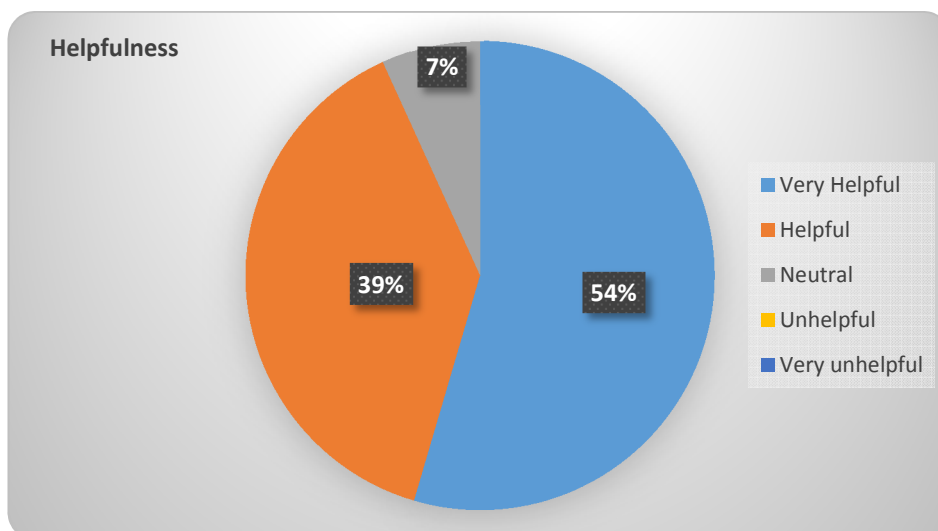


Figure 7. Perceived helpfulness of formulation group T1 and T2 combined

Overall, the majority of staff found the “Hot Cross Bun” formulation as a way of understanding patients either “helpful” or “very helpful”.

Question 11 - Do you have any other comments or suggestions about the formulation groups?

Staff had the opportunity to make general comments about the formulation group. Positive comments revolved around it being helpful, informative and person-centred. One commenter also mentioned the importance of the facilitator in successfully managing the group (“excellent facilitator; helped the MDT take a step back and carefully think about each patient discussed”). Shortcomings voiced mainly revolved around not being able to attend (“Due to working long term nights I've been unable to attend formulation groups - will attend in near future”).

Recommendations made included managing the rota to enable different staff to attend, publicising the group among staff, staff taking the lead in presenting at the meetings and allowing all staff to attend (“it would be useful if admin staff were allowed to attend”).

4.2 Focus groups

A total of 22 staff attended the focus groups across the three wards: 6 nurses, 2 student nurses, 9 support workers, 1 occupational therapist and 1 trainee clinical psychologist. Of those at the focus groups, only one staff member had never attended at least one formulation group.

Thematic analysis of the three focus groups recorded a total of 19 themes, which fell into one of three general descriptions: strengths, weaknesses and recommendations.

4.2.1 Strengths

4.2.1.1 Confidence

Focus group participants commented that the group gave them more confidence in carrying out their job, both in terms of highlighting existing strengths (“we know more about patients

than we thought we did”) and possible new directions (“... you feel less stuck, more confident when you leave”). It was also noted that the ethos of the group as “a place to explore ideas” with “no right or wrong answers” contributed to feeling confident when discussing clients in the formulation meeting.

4.2.1.2 Helping when stuck

A number of comments suggested the groups were helpful in finding new ways forward when staff felt stuck with a particular patient (“It really helps with challenging behaviour and people that have been on the ward a long time and the team feel a bit stuck with”)

4.2.1.3 Better understanding of the patient

Participant’s brought up the fact that formulation groups provided a chance to find out more about the patient. This helped staff empathise (“It’s good to think about the person’s thoughts. You’re putting yourself in the patient’s shoes”), make more sense of behaviour (“one man was displaying some odd mannerisms, but actually his wife said he’d always had these mannerisms. They were things he’d done all his life”) and use past experience to inform patient management (“...you lose a bit of the person with dementia, so you can’t see the person they were when they’re on the ward. Knowing what they were like in the past you can think of things that may help, like if they were a boxer, or liked music ... you can then put on music while they’re doing something”).

4.2.1.4 Sharing information

Linked to the above theme, staff valued having a platform to share information about patients. Benefits of this were related to learning new information (“Staff who are on the floor can give you so much information on a patient, particularly when there's not a lot of background. Like when there's no informant, when they don't have family. It goes way beyond what you can find in the notes”) and gaining different perspectives to problems (“You get lots of ideas coming together”).

4.2.1.5 Improved teamwork / team feeling

Focus group participants described the formulation groups as without “hierarchy” and felt this contributed to feeling part of a team (“There's more of a team feeling in the group ... everybody's input is equal”). This appeared to be augmented by the ethos of the group (“Everyone listens”; “People respect each other even if they don't agree”).

In addition, there was a recognition that jointly contributing to the formulation led to responding to patients in a more consistent manner (“It's better for patients ... we have a more unified approach ... there's a less varied response from staff ... it gives a clearer message to the patient”)

4.2.1.6 Impact on patients

Lastly, staff were clear that there had been cases when group outcomes had resulted in a clear positive change with a patient (“There are clear examples of when a patient's behaviour has changed as a result of what has come out of the group) and that this was seen by many as the main value of the group. Even when the mechanism for change was less clear, it was felt that formulation could contribute to treatment (“Sometimes it's difficult to work out what's

working, because on the ward there's never one thing being done to a patient. There might be the formulation, meds, ECT ... and it's difficult to know what's made the difference, but the formulation group is one of many interventions to try”).

4.2.2 *Weaknesses*

4.2.2.1 Lack of awareness of formulation groups

Although all but one of the focus group participants had attended at least one formulation group, the individual who had not attended reported that they were unaware of them and had never been invited. Other members of the focus group acknowledged that there were staff on the ward who remained unaware of the group.

4.2.2.2 Poor communication

Although staff felt outcomes from the formulation groups were valuable, a main concern raised was that information from the groups did not get disseminated throughout the ward (“I think often things go wrong. So, the primary nurse will know that the care plan needs updating, but needs to find time, or it gets shared at handovers, but will only be shared at one handover, they won't get passed further”)

4.2.2.3 Feasibility of action points

In some cases the staff reported that action points could not be practically executed. Reasons for this included the patient being too ill to engage with suggested interventions (“...The action points will say “talk to this person about their past” or something, but the person won't even be able to talk to you and sometimes they get annoyed, so how do you do that?...”; “The

action points feel relevant for the person, but not always for the person in this moment in time ...”) or that the patient’s presentation can change rapidly (“The situation on the ward can change rapidly, so action points become outdated fast”)

4.2.2.4 Impact on patients

While staff reported clear examples of change in some patients, they equally acknowledged that there were others this approach was less effective for (“Cognitively intact’ people are harder to deal with in formulation. When the problem is they say “I won’t do that, you can’t make me””). Additionally, aforementioned communication problems impacted the degree that action points were implemented (“Only 50% of the care plans are being changed at the moment”).

4.2.2.5 Staffing shortage

Staffing issues were cited as a barrier for both attendance of formulation groups (“There have to be people to cover the floor”) and for dissemination of ideas from the meetings (“People won't know about groups or look for information on them – everyone already has so much work there's no time. They're not going to go and look at the formulation”).

4.2.2.6 Ward culture

Elements of how the ward is run acted as barriers to group attendance and communication and implementation of action points. These included the high client turnover and the chaotic nature of ward work, a lack of protected administration time for nurses, beliefs around the group’s transience and importance (“We've had a lot of groups that have run for a while and

then faded away. We need to stick at it ... we need to show it's not just an idea that will fade”) and resistance from some staff members (“Some of the staff feel it just takes them away from work ... They don't see the benefit”).

4.2.3 *Recommendations*

4.2.3.1 Clear structure

Consistent use of a recognisable formulation template was seen by staff as beneficial and efficient. This was particularly emphasised by those working on a ward without a full time psychologist (“People are comfortable with the format, we're used to it ... it's constant across facilitators”).

4.2.3.2 Flexibility

Although not an explicit rule of the formulation groups, staff valued flexibility around joining the formulation group (“One really good thing it that you are able to come in even if you miss the start ... Or if you're in and get called away, that's ok”; “Even if you can't stay for it all, you're more likely to go and find out about it after”).

4.2.3.3 Improving communication

Staff came up with numerous suggestions around improving the communication breakdowns described earlier. These included putting a note on the electronic patient journey system (ePJS) events page notifying people that the patient had been formulated, photocopying rough notes to immediately share at handover and not relying on the primary nurse to update care plans.

4.2.3.4 Revisiting formulations

When action points are not effective, focus group participants highlighted the helpfulness of revisiting and rethinking formulations (“One useful thing that doesn't always get done is reviewing the patient at the next formulation group. When the action points haven't worked it's good to be able to feedback and think about how to change them”).

4.2.3.5 Providing feedback on group efficacy and impact

It was felt that tangible changes and benefits that the formulation meetings contributed to should be shared with all ward staff – not just at managerial level – in order to continuously remind staff of the rationale behind running the groups.

4.2.3.6 Increasing awareness

It was acknowledged that more could be done to raise awareness of the formulation group among those who currently do not attend, although no specific ideas were raised.

4.3 Differences across wards

The focus groups revealed notable differences between the feedback from different wards.

Staff on Hayworth had a far greater focus on the emotional benefits they gleaned from the group, in addition to other positives (“It gives staff a chance to air views, get it off their chest”).

They also reported fewer difficulties regarding the dissemination of information from groups (“The care plan changes and people follow that”; “... People pull you up if you are using the old methods with a person”),

On Chelsham and Hayworth wards, the formulation group was very much “owned” by the nursing and health care assistant staff. In contrast, the AL1 group appeared to attract a greater range of MDT staff, such as medics and allied health professionals.

Staff on Chelsham in particular promoted the value of revisiting formulations for patients they found challenging. A review of the last patient formulated was occasionally done at the start of the group, and these recaps and reformulations were cited as extremely helpful.

5. DISCUSSION

5.1 Summary of results

The results indicate that staff satisfaction with the formulation groups was high. Staff were largely satisfied with the group structure and the way patients were formulated; the outcomes and objectives that emerged from the formulations; and were comfortable contributing in the group. Importantly, all staff responses stated that attending the formulation group had impacted the way they worked at least a little, with the majority of responders (77%) saying it had impacted a lot. Most people reported being satisfied with the timing of the group and those that were not recognised the rationale for the timing of the group and reflected that there was no “ideal” time for it to run.

Staff identified a number of advantages and benefits the formulation group provided, including confidence working with patients; finding ways forward when stuck; better understanding patients; sharing information; improved teamwork and the positive impact on patients. They were also active in highlighting areas where the groups could be bettered and making suggestions about how to address them. These included increasing awareness of the group among the staff team, improving communication and feasibility of action points, and addressing practical and systemic barriers to the group, such as staff shortages and the ward culture.

5.2 Implications of findings

Results from the satisfaction surveys and focus groups are encouraging. The study aimed to investigate what benefits (if any) staff felt the formulation groups brought to their day-to-day work and found that staff valued sharing knowledge and the emotional impact of the work with one another, as well. The positive aspects discussed in this evaluation are consistent with those reported in past studies (Summers, 2006, Davenport, 2002) and those outlined in the *Good practice guidelines on the use of psychological formulation* (DCP, 2011). In particular, the support formulation groups give with complex cases may be particularly valuable in an inpatient setting where, as one staff member put it, “all our cases are complex”.

For the purpose of improving the service, the study also aimed to elicit areas of dissatisfaction for staff and barriers to engaging in the formulation group. Many comments related to difficulties disseminating information from the formulation group among ward staff, which acted as a barrier for new ideas to be consistently implemented. Reasons for this echo Down's (2010) reporting of formulation time getting “eroded” by other demands; it appears this is not only the case around attending formulation groups, but also in ensuring administrative tasks around the group (updating the care plan; seeking out the formulation after the group) are carried out. Staff also talked of the formulation groups not yet being “embedded” in ward culture, which may reflect

Johnstone's (2013) notion of a “culture clash” between formulation and how the ward is run, resulting in the formulation groups taking less precedence than other ward activities and responsibilities.

In some cases formulating patients had limited impact. However, positive experiences regarding the impact on specific patients were also fed back, which suggests a slightly more

positive outcome than reported by Summers (2006). For example, all staff were explicitly aware of the need to incorporate formulation group outcomes into patient care plans. In particular, staff reports of an increase in empathy towards patients implied that formulation can make a valuable contribution to the Government's three-year *Compassion in Practice* strategy for nursing and care staff (NHS Constitution, 2012) that was created following the Francis Report (Mid Staffordshire NHS Foundation Trust, 2013).

5.3 Possible areas for improvement

A number of areas for improvement were identified by staff. These related to flexibility; improving communication; revisiting formulations; providing feedback to staff on the group and increasing awareness.

5.3.1 Flexibility

Staff on one ward commented on the value of flexibility around joining formulation groups a little late and understanding when staff get called away before the end. This was not explicitly how the facilitators envisaged the group being run and in fact some explicitly felt this way of working was not helpful. However, this feedback may highlight the need to compromise around allowing latecomers to partake, given the busy nature of the wards. It may be possible to make adaptations to the group to minimise disruption, such as using an overhead projector so that people can see what had already been covered.

5.3.2 Improving communication

Although different steps had been taken across wards to disseminate information from the groups (e.g emailing staff, uploading formulation group onto ePJS), the need for the

information to come to staff, as opposed to them seek it out, was emphasised. Suggestions included posting event notifications on ePJS and sharing rough notes immediately, but were mainly focused around incorporating recommendations from the group into care plans.

It was recognised that the speed at which care plans were updated may be improved if responsibility were taken on by attending staff rather than the patient's key worker. Given that such difficulties were not reported on Hayworth ward, it would be helpful to investigate what occurs on the ward to enable thorough dissemination.

5.3.3 Revisiting formulations

Several staff stated that occasionally past formulations were revisited at the start of the group and that they wished this to be a more regular occurrence. Despite limited time, revisiting formulations can be valuable to rethink why action points may not have worked, highlight change that has occurred and maintain the formulation as a "working hypothesis", rather than "truth".

5.3.4 Providing feedback on group efficacy and impact

Staff talked of the importance of "embedding" formulation groups in ward culture and how this could be done. Many of the suggestions were in line with Johnstone's (2013) comments on the need to show staff tangible outcomes from formulation groups, such as behavioural change in patients before and after formulation. In addition, this may be an important step in getting influential members of staff "on board", as suggested by Lake (2008).

There was an implicit suggestion that protected time – both for the groups themselves and for updating care plans (i.e. the key worker getting protected time to do administrative tasks

around formulation group) – would be beneficial. The need for formulation groups to be seen as part of the ward culture is a necessary step to enable such actions to be taken.

5.3.5 Increasing awareness

Staff recognised that as the groups were ongoing, there was little promotion of them and little effort to engage people not currently attending. In addition to providing feedback, acknowledgements in other team meetings, ongoing encouragement and posters / flyers may all help promote awareness of the formulation group on the ward.

As a result of the evaluation, several developments are in progress within the service.

Facilitators of the formulation groups have been able to immediately adapt the groups to take into account some of the feedback provided, around revisiting formulations and flexibility.

There have also been discussions around the feasibility of running groups more frequently to allow more consistent reviews of previous formulations. Additionally, sharing the findings of this service evaluation – throughout both managerial levels and ward staff – will be a step towards providing feedback on the impact of the group on the ward. This may also contribute to raising the profile of the group among staff members who may not be aware of it. Another useful step may be to hold a brief discussion with staff on Hayworth ward around what is in place to enable dissemination of information from the formulation group and check that such structures are set up on the other wards. Finally, the MHOA CAG plan to roll out formulation groups on the Specialist Care Units. This evaluation will help support and inform the best way for this to be implemented.

5.4 Limitations and future directions

There are several limitations in the current evaluation, relating to methodology and design as well as scope of the project.

One issue is around the validity of the data collected. Although responses from the satisfaction questionnaires included both attendees and non-attendees of the formulation group, it is unclear what percentage of the total staff on each ward completed the questionnaires. Additionally, although efforts were taken to get a representative sample of ward staff to attend the focus groups, it was noted that this did not happen in practice. Therefore, it cannot be presumed that the responses received are reflective of overall staff opinion.

The above point is important as there is evidence that levels of dissatisfaction are higher among non-responders (Stallard, 1995). Those who declined to take part may have done so because they did not engage in the group and do not feel it worthwhile. Conversely, motivation to participate in the evaluation may have resulted from an appreciation of the group and a wish for it to continue, thus biasing responses. Also, it has been found that responder's negative experiences do not necessarily correlate with their evaluations if they do not see the service they were receiving as culpable for the negative experience (Williams, 1998). The project's inclusion of qualitative data via focus groups and open-ended questions in the questionnaire and may have helped remedy this, as there is evidence that specific negative experiences are more likely to be reported in qualitative studies (Avis, Bond, & Arthur, 1997).

It is also possible that the evaluation context may have shaped responses. As previously mentioned, the knowledge that the facilitator of the focus groups was a trainee psychologist may have led to staff giving "acceptable" responses. Additionally, resources were not available to conduct the best practice of having a separate person to the facilitator transcribing the data (Stewart, 1990), increasing the risk of bias to what was transcribed. However, the fact that

negative views as well as positive were expressed in the focus group, and were consistent with comments made in the anonymous satisfaction survey responses, suggests that data collected is valid.

The data reported in the current service evaluation collected subjective opinions on the impact of the formulation groups. This fails to address a key need highlighted by Johnstone (2013) to collect specific outcomes on the impact of formulation on aspects of care such as service user recovery rates or staff sickness. However, it is important to note that the investigation into staff satisfaction with formulation groups covered in this service evaluation was part of a larger project, which aimed to evaluate the impact of the groups on care plans. It is hoped that this additional research will provide evidence on the degree to which action points from the formulation groups are being put into practice. Further steps to investigate this may be to investigate service user outcomes such as dementia mapping or frequency of incidents logged on ePJS.

6. CONCLUSION

Overall, the evaluation provided useful information on staff satisfaction with the inpatient formulation group. In addition, suggested areas for development have led to recommendations for the ongoing improvement of the formulation group to meet the needs of staff and service users on the wards.

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8. APPENDIX

8.1 Appendix 1: Formulation group templateCBT Formulation Part 1 – Longitudinal – How we got hereNAME

(Early) Experience

--



Schemas\Core Beliefs\First Principles



I am...

--

Other people are...

--

The world is...

--

Literature Review

Rules for Living



Biological + Neurological Issues



Trigger(s) to current problem



Consequences / Current problem

Go to Part 2 – The Here and Now.....

Implications for Care Plan - Action Points

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

8.2 Appendix 2: Satisfaction survey

Feedback on team formulation meetings

1. How satisfied are you with the structure of the meetings?

Very satisfied	Satisfied	Neutral	Dissatisfied	Very dissatisfied
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2. Do you have any suggestions for how we could improve the structure of the meetings?

.....

.....

.....

3. How satisfied are you with the time and day of the meeting every second Weds (14.00-15.00)?

Very satisfied	Satisfied	Neutral	Dissatisfied	Very dissatisfied
----------------	-----------	---------	--------------	-------------------

4. Do you have any suggestions for alternative times?

.....

.....

5. How comfortable do you feel about contributing within the meeting?

Very comfortable	Comfortable	Neutral	Uncomfortable	Very uncomfortable
------------------	-------------	---------	---------------	--------------------

6. How satisfied are you with the outcomes and objectives produced by the meeting?

Very satisfied	Satisfied	Neutral	Dissatisfied	Very dissatisfied
----------------	-----------	---------	--------------	-------------------

7. Do you have any suggestions for how we could improve the outcomes and objectives??

.....

.....

.....

8. How much do the meetings influence your work with individual patients discussed in the meetings?

Very much	Somewhat	A little	Hardly at all	Not at all
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9. In what ways have meetings influenced your work with individual patients discussed in the meetings?

.....

.....

.....

10. In general, how helpful do you find the hot-cross bun formulation used in the meetings?

Very helpful	Helpful	Neutral	Unhelpful	Very unhelpful
--------------	---------	---------	-----------	----------------

11. Do you have any comments or suggestions about the formulation?

.....

.....

.....

Please indicate which staff group you belong to:

HCA ☐ Nurse ☐ Medical ☐ Allied Health Prof. ☐

Other ☐ (please specify) _____

Thank you for your feedback!

8.3 Appendix 3: Focus group prompt questions

General

- What was the most useful thing about the group?
- What was the most difficult thing about the group?

Attendance

- How easy was it getting to the groups?
- What kind of things got in the way if / when you weren't able to attend?

Care plans

- Were any idea incorporated into client's care plans? If not,
 - What got in the way of them being incorporated?
 - Are there ways to better ensure ideas do get incorporated?

9.

Models

- How useful was the hot cross bun (or predominant model used in groups)?